S·A·R·E/A·C·E

Southern Region 1993 SARE\ACE Report to Congress

Sustainable Agriculture Research and Education and Agriculture in Concert with the Environment

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The Southern Region consists of:

Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, Virginia, and the Virgin Islands

FOREWORD

Sustainability is a broad concept that has received extensive recent discussion. Applied to agriculture, sustainability refers to the optimum use of a wide array of biological and physical processes to ensure continued production of food and fiber with less dependence on purchased inputs. Sustainable systems rely on developing and utilizing new information about complex biological systems which will maintain soil productivity, improve water quality, and reduce insect, disease and other pest problems. The projects funded by the Southern Region Sustainable Agriculture Research and Education Program will provide the foundation for moving toward sustainable agricultural systems that will be productive, profitable and renewable.

William H. Brown
Program Coordinator
Southern Region

SARE/ACE 1993 *Southern* Region Report to Congress
Executive Summary

Selected Highlights of Southern Region Projects

Livestock-Crop Systems

A project initiated in 1988 as a long-term interdisciplinary project compares conventional livestock and crops systems utilizing best management practices and a sustainable agriculture system involving crop rotations and grazing minimizing fertilizer and pesticide inputs. The project researchers estimate that the low-input corn production systems being developed will produce comparable yields with 75% fewer herbicides, 50-75% less nitrogen fertilizer, and 75% less insecticides. The low-input system continues to improve from a financial viewpoint over time. (See Project number LS91-37 in PART II of this Regional Report to Congress.

Pest Management

About 10,000,000 pounds of insecticide are now applied annually to 600,000 acres pecan orchards in the U.S. An alternative system being tested utilizes winter legumes to encourage beneficial insect predators and parasites for pest control, and to supply nitrogen used as a green manure. Fully implemented, this system could reduce insecticide application by 2/3 and eliminate commercial nitrogen applications, reducing the nitrate pollution potential. Cover crops also enhance biological control of pests in vegetable crops. Benefits include reducing soil erosion, promoting soil health, reducing the health hazard to farmers, and stabilizing farm income. (See Projects (LS91-36 in PART II and AS92-2 in PART III.)

Waste Products Regenerated

Disposal costs and ground water contamination from poultry waste are major concerns due to the expanding poultry industry in the Southeastern and Mid-Atlantic areas. The goal of a new Southern Region project is to enhance the financial value of poultry litter and protect ground and surface water quality. Marketing strategies and distribution programs are being developed for value-added production procedures. (See Project AS92-1)

Whole-Farm Planning

CROPS, the Crop Rotation Planning System for Whole-Farm Environmental and Economic Planning, being developed at VPI is a computer program that can generate a whole-farm plan over a six-year planning horizon. This planning tool will tell the farmer the economic and environmental consequences of farm operating decisions. (See Project AS92-4)

Regional Program Activities

In FY 1992, a total of 227 preproposals were submitted in three categories: experimental component, integrated systems, and strategic planning. Of the 52 preproposals accepted for development into full proposals, 11 were ultimately funded. In 1993, 208 preproposals were reviewed; 45 were selected for development of full proposals; and 11 were funded. (See Appendix to Part I, Tables 1 and 2.)

The Southern Region Administrative Council expanded the review procedures to include a pool of more than 250 technical reviewers in a variety of expertise areas. The Council also expanded its own membership to include additional farmer representatives. (See Appendix, Table 3.) Priority areas of interest in the Southern Region for research and development include agro-forestry and animal systems, multiple use of forage/grassland systems, conservation tillage/crop residue management, biological diversity, pollution prevention, and fish/wildlife habitat. Projects funded in FY 1992 covered a wide range of interests, including such areas as

- use of organic soil amendments of agricultural by-products for vegetable production systems (LS92-49),
- farm scale evaluation of alternative cotton production systems (LS92-47),
- the effects of sustainable and conventional agriculture on farm wildlife (AS92-5), and
- computer software (CROPS) for crop rotation planning for whole-farm systems, including environmental and economic components (AS92-4).

'State of the South'

A strategic planning project involving farmers, universities, private and public entities is evaluating the status of sustainable agriculture as practiced by farmers in the Southern Region. This project seeks to clarify the goals and future funding needs of educational and research projects that are of interest to all Southern residents, including farmers and ranchers. (See Project LS92-50)

Administrative Council 'Forum'

In an effort to expand information exchange between organizations interested in sustainable agriculture, the Southern Region Administrative Council invited representatives from several farm organizations to discuss how the SARE/ACE program can be improved. The organizations participating in the Forum were the National Pork Producers Council, Southern Sustainable Agriculture Working Group, National Cattlemen's Association, American Forestry Council, and the Farm Bureau Federation.

Table of Contents

PART I. OVERVIEW

The SARE and ACE Programs

The Sustainable Agriculture Research and Education (SARE) program was established to replace the former LISA program, which was started in 1988. The SARE program is authorized by Chapter 1 of Title XVI of the Food, Agriculture, Conservation and Trade Act (FACTA) of 1990. The general goal (as stated in Sec. 1602 of Title XVI) is to:

(1) **continue to satisfy human food and fiber needs;**

(2) **enhance the long-term viability and competitiveness of the food production and agricultural system of the United States within the global economy;**

(3) **expand economic opportunities in rural America and enhance the quality of life for farmers, rural citizens, and society as a whole;**

(4) **improve the productivity of the American agricultural system and develop new agricultural crops and new uses for agricultural commodities;**

(5) **develop information and systems to enhance the environment and natural resource base upon which a sustainable agricultural economy depends; or**

(6) **enhance human health -**

- **by fostering the availability and affordability of a safe, wholesome, and nutritious food supply that meets the needs and preferences of the consumer; and**

- **by assisting farmers and other rural residents in the detection and prevention of health and safety concerns.**

In 1991 the U.S. Department of Agriculture and the U.S. Environmental Protection Agency cooperated in establishing a new grants program patterned after LISA and SARE. This new program, entitled Agriculture in Concert with the Environment (ACE) is administered through the Regional Administrative Councils, along with the SARE program. The United States Environmental Protection Agency (EPA) is committed to the premise that prevention is the first priority within an environmental management hierarchy that includes prevention, recycling, treatment and disposal. In agriculture, EPA and USDA prevention efforts concentrate on issues such as:

- Reduction of the misuse of agricultural chemicals including pesticides and fertilizers and animal waste,

- Adoption of reduced risk pesticides and/or biological controls, and

- Protection of ecologically sensitive areas.

These interests are compatible with USDA goals including those of the SARE program, the Soil Conservation Service, Extension Service and others. EPA is pleased to work in partnership with USDA on ACE and other activities to further the mutual goals of sustainable agroecosystems. EPA believes that the $3.0 Million dollars contributed to the ACE program to date has been a solid investment of funds, and demonstrates the commitment of the EPA - USDA partnership to prevent pollution from agricultural sources.

Highlights of Selected Southern Region SARE and ACE Projects

Following are highlights of 1992 results of 3 SARE and 5 ACE research and education projects from the Southern Region. For more information about any of these projects, please refer to Parts II and III of this document, where detailed project descriptions and progress reports have been compiled, in order by project identification number.[1]

Funding from the EPA Agriculture in Concert with the Environment Program to the USDA Southern Region Sustainable Agriculture Research and Education Program began in FY 1991. The first funds from the ACE program arrived after the FY 1991 Call for Proposals had been initiated. Therefore 1991 and 1992 funds were combined into the FY 1992 projects. This report reviews projects which were accepted for funding by the ACE program. Since the projects have only recently been accepted and funded, this report is based on proposal applications and communications with the project coordinators. Conclusions are subject to forthcoming research results.

Selected projects funded through the SARE program have also been reviewed. Research results are available for review from these projects. Each project is introduced by the title of the project, name and address of principal investigator, SARE/ACE funds received, matching funds provided. Examples of potential economic benefits that could be derived from the project results are presented. Environment benefits or reductions in environmental damage by the use of the suggested sustainable/alternative practices are discussed in general. Specific impacts have not been calculated to date by these projects, but will be considered as the projects develop.

SARE Projects

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1. In assigning identification numbers to the projects, e.g. LS88-1, the "L" indicates the project was funded by the LISA program or its successor, SARE. Project numbers beginning with the letter "A" were funded by the ACE program. The year the project first received funding is indicated before the hyphen, "88;" preceded by the region, "S" for Southern Region; and followed by a sequence number, "1" for the first project on the 1988 list.

LS91-37: "Low-Input Crop and Livestock Systems for Southeastern United States" Project Coordinator: **Vivien Allen**, Dept. of Crop and Soil Environmental Sciences, VPI&SU, Blacksburg, VA 24061, 703-231-9797

SARE Funds: $160,000 Matching Funds: $95,160

Potential Economic Value: Up to 75% reduction in herbicide, nitrogen fertilizer, and insecticide using suggested corn production system. After a transition period of 5 years, the net income from LISA compared to conventional systems will be equal to or better than the conventional system.

Overall goals of this project are:

- to develop and evaluate crop and livestock farming systems that minimize reliance on non-renewable inputs while maintaining their economic viability,
- improving long-term soil productivity, and
- minimizing undesirable environmental impacts.

Preliminary results indicate that reduced chemical input systems utilizing an increased integration of on-farm resources can produce identical cattle weight gains with similar net profit, but with a substantially reduced need for nitrogen fertilizer, herbicides and insecticides.

This project was initiated in 1988 with funding from the LISA program. It is an example of a long-term interdisciplinary research and education project and consists of two major components: (1) a comparison between a conventional livestock and crops system utilizing "best management practices" and an experimental "LISA" system involving more crop rotations and grazing, and (2) the development and implementation of reduced chemical input corn production systems.

The Farming Systems Project is replicated at a farm-scale level. The LISA system endeavors to minimize fertilizer and pesticide inputs whenever feasible. The second component includes the use of conservation tillage systems, winter annual legume cover crops, and integrated pest management practices for weeds and insect pests.

An economic analysis of the LISA and conventional systems indicates in the initial year of establishing the project (1989), both systems failed to cover variable costs -- with net losses of $721 and $713 per hectare, respectively. The financial performance of these systems has continued to improve from year to year, net loss has declined to $238 per hectare in both systems.

On-farm research has shown that rye and hairy vetch cover crops can substantially reduce N fertilizer need and provide increased weed control in corn silage production systems. Total forage production in 1990 and 1991 was greater or similar for the LISA system compared to the conventional system.

Corn grown using vetch cover crops as a no-till mulch required approximately one half the non-renewable energy input as corn grown using 140 kg/ha (125 lbs N/a) supplied from manufactured nitrogen fertilizer. No-herbicide corn production systems using mechanical methods for killing cover crops combined with a modified strip-tillage practice have produced comparable corn silage yields to conventional methods using herbicides for killing cover crops and weed control.

For corn planted into rye cover crops, banded herbicide application plus a single cultivation with a no-till cultivator produced corn yields comparable to broadcast herbicides, allowing a 50% reduction in herbicide usage.

As an additional benefit, long-term research projects can allow for improvement in production methods as the project evolves. In 1992, the LISA corn production system was changed to utilize new developments in reduced chemical input corn based on the on-farm experiments conducted in 1991. Disk-rolled cover crops were utilized for better weed suppression and moisture conservation. Weed populations within the corn blocks were more than twice as great in the LISA systems in 1990, but not significantly different in 1991.

The overall project includes several specific components:

- Evaluation of weed management in corn strip-till planted into mechanically-killed rye and vetch cover crop offers the potential to dramatically reduce or eliminate the need for herbicide in this crop production system. Disk-rolled plots with no paraquat and no herbicide provided higher, but statistically equivalent, corn silage yields compared to mulch-removed treatments with broadcast herbicides.

- A pest management scouting program for armyworm and cutworm in field corn was begun in 1991. Data collected strongly suggest that prophylactically applied insecticides are not economically justified. High populations can be detected using systematic scouting to apply insecticides only when necessary.

- Energetics of legume cover crops compared to nitrogen fertilizer for corn production were compared. In corn silage production, cover-cropped treatments had a significant advantage over standard practice treatments in terms of overall energy expenditures for field operations.

- Cover-cropped no-till treatments required an average energy expenditure of 9026 MJ/ha compared to 19,763 MJ/ha required by the standard practice no-till treatment. Alternative practice treatments that utilize vetches to provide nitrogen for corn production performed significantly better than standard practice treatments in terms of energy use per unit of crop output. An alternative hairy vetch no-till treatment produced a $33/ha greater average net revenue than the standard practice no-till treatment and $115/ha greater average than hairy vetch disked treatment. The project researchers estimate that the low-input corn production systems being developed through this project will produce comparable yields with 75% fewer herbicides, 50-75% less nitrogen fertilizer, and 75% less insecticides. Presently in the United States, approximately 50% of the pesticides and 44% of the chemical fertilizers are used in

corn production. The scouting program being initiated in this project can lead to an implementation of an Integrated Pest Management (IPM) program for corn in Virginia and elsewhere, which could lead to a substantial reduction in both insecticide and herbicide use.

LS91-36: "Pest Management and Orchard Floor Management Strategies to Reduce Pesticide and Nitrogen Inputs"
Project Coordinator: Michael Smith, Dept of Horticulture & Landscape Architecture, OSU, Stillwater, OK 74078, 405-744-6463

SARE Funds: $150,000 Matching Funds: $74,656

Potential Economic Value: Production savings of $10,595,100 annually from aphid control and decrease in production loss. Legumes will provide an equivalent of $27.93 per acre of nitrogen and could eliminate the need for commercial application of nitrogen.

The purpose of this study is to develop and test a pest management and orchard floor management system for use by pecan growers. Commercial pecan states extend from Florida to N. Carolina and west to California. There are 600,000 acres of intensively managed pecans in the U.S. and thousands of additional acres receiving lower levels of management. Current use of insecticide applications to pecan trees disrupt the balance between pest species and their predators, resulting in serious outbreaks of aphids, mites and leafminers. The system being tested utilizes:

- winter legumes interplanted in pecan orchards to produce and manage native beneficial insect predators and parasites for early-season aphid control; legumes used as green manures will also supply nitrogen;

- a release program of predators and parasites will be investigated for control of aphid and lepidopteran pests; and

- pathogenic fungus inoculation for the control of pecan weevil.

The economic and environmental advantages of bio-control and an alternative nutrient supply will be evaluated. About 10,000,000 lbs. of insecticide are applied annually to pecan orchards. Fully implementing this methodology could reduce insecticide applications by 2/3 and eliminate commercial nitrogen applications, thereby reducing the NIB pollution potential.

LS91-38: "Developing and Extending Minimum Input Strategies for Weed Control in Agronomy and Horticultural Crops"
Project Coordinator: Ford Baldwin, University of Arkansas

SARE Funds: $100,000 Matching Funds: $107,571

Potential Economic Value: In soybeans, reduced herbicide inputs by 7 to 9 million lb./A/yr with a cost savings potential of $150 million in the southern region. In horticultural crops, reduced herbicide inputs by 100,000 to 200,000 lb./A/yr with a cost savings potential of $2 to $e million/yr.

In the 1980's, research was begun at the University of Arkansas to demonstrate that soybean herbicide rates could be reduced to a fraction of the rates on the herbicide label with no loss in weed control or crop yield. In this program, herbicide costs have been reduced from by 25 to 50 percent, saving $5 to $10 per acre, with a corresponding reduction in the herbicide load in the environment. Surveys indicate that approximately one-third of the Arkansas soybean producers have adopted this technology at a cost savings of $7 million annually. The program is expanding the reduced rate herbicide program further to reduce inputs 4 to 5 fold by spraying very narrow bands. Concepts developed for soybeans are being adapted for other agronomic and horticultural crops. The program is being adopted by other states. For example, in 1990, Missouri initiated written recommendations for a reduced herbicide input program, based in part on results from this study.

ACE Projects

AS92-1: "An Integrated Technological and Marketing Strategy to Make Broiler Production More Sustainable"
Project Coordinator: Sandra Miller, Winrock International, Rt. 3, Box 376, Morrilton, AR 72110, 501-727-5435

ACE Funds: $200,000 Matching Funds: $374,904

Potential Economic Value: Use of litter from Arkansas and Oklahoma converted to value added products of cattle feed or fertilizer produce $398,925,000 and $66,350,000 respectively.

The goal of this integrated education, research and demonstration project is to increase utilization of poultry litter produced in ways that increase its economic value and protect ground and surface water quality.

U. S. broiler production is concentrated in the Southern Region. In Arkansas and Oklahoma, where the project will be carried out, more than one billion broilers produced 2.5 million metric tons of litter in 1990.

The findings of this study will be applicable throughout much of the Southeastern and Mid-Atlantic region of poultry production. Each area of poultry production generates greater quantities of litter than applicable for local land use, causing deterioration of water quality. By developing more effective marketing strategies and distribution programs, potential environmental and social benefits are expected. Proper utilization in production and nonproduction areas will alleviate water quality problems, nutrients in poultry litter can reduce the reliance on fossil fuel based fertilizers, and an educational program on proper application can improve soil organic matter, water holding capacity and reduce depletion of ground water.

Nutrients in litter have been estimated to have a value of $159.57 per ton as an ingredient in cattle feed and $26.54 per ton as fertilizer (Fontenot, 1991). Uncalculated value of litter, in addition to its nutrient value, may be derived from its ability to increase soil organic matter, improve water-holding capacity and rate of water infiltration, providing soluble micro-nutrients, and suppressing certain pathogenic bacteria, fungi, and nematodes potentially reducing the need for pesticides. Environmental concerns combined with the potential economic benefits may provide new incentives for litter markets to emerge.

This project will analyze existing marketing practices, develop strategies to reduce variability of raw litter for value added production procedures (e.g. fractionization technologies, potting soils, feeds). On-farm demonstrations will develop storage facilities, nutrient management plans to minimize run-off and leaching from land application under inappropriate conditions, and demonstrate the benefits to farmers of ASCS 75% cost share available through Water Quality Demonstration Project in FY 1993. An education program will be developed for clean-out contractors to improve their knowledge to reduce water quality problems associated with land application and improve profitability.

AS 92-2: "Habitat Enhancement for Beneficial Insects in Vegetable Production Systems"
Project Coordinator: Janet Bachmann, Rodale Institute, Route 8, Box 406, Fayetteville, AR 72701, 501-443-9388

ACE Funds: $200,000 Matching Funds: $79,975

Insect control is often a primary obstacle to overcome in the development and implementation of sustainable cropping systems. The proposed research seeks to develop and evaluate cropping systems that incorporate the use of companion and/or cover crops to enhance levels of biological control of key pests of horticultural crops. These integrated agroecosystems will serve as models for expanded research for other plants and herbivores in other locations.

Enterprise budgets will be used to determine the economic feasibility of the different production systems. Selective management of cover crops and adjacent vegetation may have a positive impact on pest management in crop systems. Besides reducing soil erosion and promoting soil health, cover crops have been shown to reduce pest population densities in vegetables. The use of companion crops as part of a biological insect pest management system in conjunction with

vegetable cash crops has not been widely adopted because the effectiveness of companion species in reducing insect pest population densities has not been well documented nor has the economic feasibility been assessed.

Enhanced environmental and economic value may be provided to the farmer through: reduction in pesticide use; reduction in health hazard to farmers who apply insecticides; additional economic return from companion plants which have a cash crop value; diversification of farming system which may help to stabilize farm income. Using biological diversity on the farm as an internal resource, energy consumption, species loss, and costs of production may be reduced.

AS 92-3: "Integration of Natural Enemies for Management of the Sweetpotato Whitefly and Associated Disorders on Mixed-Cropped Vegetables"
Project Coordinator: David Schuster, UF, IFAS, 5007 60th St., E., Bradenton, FL 34203, 813-751-7636

ACE Funds: $170,000 Matching Funds: $77,789
Potential Economic Value: Reduction of commodity losses in Florida and Texas of $250 million per year

The sweetpotato whitefly (SPWF) became a major pest in Florida in 1986 and in Texas in 1990. Presently it is damaging agronomic and horticultural crops across the Southern Region of the U.S. plus NM, AZ, and CA. In Florida, the insect has been shown to transmit a new geminivirus of tomato. Annual losses to tomato producers in Florida alone are currently estimated at $125 million. For all commodities, losses in Texas and California are at least as great. Commercial growers typically apply insecticides two to three times weekly. This situation is not stable and risks further disruption of regulation by natural enemies, occurrence of secondary pest outbreaks, and development of insecticide resistant strains of SPWF. This heavy insecticide use has

- reduced grower profits,
- increased pesticide loadings in the environment,
- increased exposure of farm workers and families to insecticides,
- increased insecticide residues in crops, and
- increased insecticide resistance in the whitefly.

This research project investigates the use of biological control methods (use of mulch and petroleum oils, artificial food supplements for beneficials, release of natural enemies) and cultural farming methods (intercropping) to develop a practical management program for the SPWF. Results of this project could be applied directly to all mixed vegetable farms in the southeast. In conventional management systems for sweetpotato whitefly, tomatoes are being sprayed 24-36

times per crop. The successful completion of this project could eliminate 50-100% of these applications, reducing environmental contamination, worker exposure and food residues.

AS 92-4: "CROPS, the Crop Rotation Planning System for Whole-Farm Environmental and Economic Planning"
Project Coordinator: Nicholas Stone, Dept of Entomology, VPI&SU, Blacksburg, VA 24061, 703-231-6885

ACE Funding: $140,000 Matching Funds: $88,247
Potential Economic Value: The CROPS software could be used as the basis for soil conservation planning for the SCS. In Virginia alone, over 40,000 farmers will be in the SCS program by 1995. If not found in compliance with their plan, farmers could lose up to $50,000 ($2 Billion for the state of VA) in crop insurance and deficiency payments.

The CROPS system is a computer program that can generate a whole-farm plan over a six-year planning horizon. The plans generated meet the requirements of the Soil Conservation Service guidelines and other legislative requirements; and they incorporate the principles of sustainable agriculture, promoting reduced leaching and runoff of nutrients and pesticides while maintaining economic profitability. CROPS addresses the problem of coordinating the crop rotation, pest management, nutrient management, and soil conservation plans, economic viability and effects on environmental quality for the whole farm.

For example, the Soil Conservation Service (SCS) has developed plans for highly erodible lands on over 40,000 farms in Virginia since 1988. Many farmers in the second and third years of their conservation plans are faced with the choice of either following the SCS conservation plans which do not meet economic and production requirements, or growing corn they need in violation of their plans and facing fines. CROPS would eliminate this dilemma.

Farmers using this farm-level planning tool will benefit from the system's ability to demonstrate both economic and environmental consequences of their operating and policy decisions. Farmers will be shown the potential rates of soil erosion under alternative farming strategies, the risks of pesticide and nitrate leaching and runoff and economic risk assessment analysis to help determine the effects of adopting conventional and/or sustainable agricultural practices. The current project will build upon previous research to expand the livestock component of the CROPS system to include manure management, improve the economic evaluation component, and modify CROPS for vegetable production systems.

The total benefits of such a system can only be roughly estimated, because (1) there are no precise measures of many of the advantages such as reduced costs to society through improved soil conservation, and an increase in self-sufficient, diversified farms, better buffered from the changes of federal farm programs and the economy; and (2) the extent of farmer adoption of CROPS is unknown. Efforts to make the program more "user friendly" are under way, to increase farmer acceptance.

AS 92-5: "Effects of Sustainable and Conventional Agriculture on Farm Wildlife"
Project Coordinator: John Anderson, Dept. of Crop Science, NCSU, Box 7620, Raleigh, NC 27695, 919-515-5818

ACE Funds: $130,000 Matching Funds: $130,100

Potential Economic Benefit: Savings from reduction of nitrogen input by 10%, phosphorus input by 15% and lbs of pesticide on the ground by 25%. Additional income to the farmers could reach $2 million in the NC coastal plain area.

Current evidence suggests that conventional crop production methods adversely affect wildlife and other natural resources. An example is the decrease in populations of bobwhite quail whose disappearance on farms is most often attributed to increased use of pesticides and decreased habitat diversity. The presence and health of bobwhite quail are, in general, excellent indicators of wildlife habitat quality and environmental quality. This project will quantify and contrast the effects of conventional and sustainable crop production methods on the population, habitat and behavior of quail and other wildlife species. The project will also seek to enhance wildlife habitat in modern farming systems by developing the concept of "improved" filter strips and field borders.

The economic potential of combined crop production/wildlife enterprises will be evaluated. Wildlife resource protection and improvement are important because the remaining islands of quality wildlife habitat in the South are generating significant incomes for many landowners. Monies spent by wildlife enthusiasts are helping to revitalize rural communities. Farmers who adopt sustainable agricultural practices and view those practices as investments in habitat improvement are likely to profit from supplemental income derived from wildlife.

From a crop perspective, the adoption of the production methods researched in this project relevant to North Carolina could affect 2 million acres in the coastal plain area. Benefits expected are due to the reduction in use of nutrient inputs, nitrogen by 10%, phosphorus by 15%, and reduction in pesticides by 25%. The savings in crop production may be reinvested for management of wildlife habitats. Additional benefits will be achieved by leasing acreage for recreational purposes at lease rates of $10/A. Estimating that 10% of the available acreage would be used for this purpose, farm income could increase by as much as $2 million.

FY 1992 Regional Program Activities

Administrative Council

- See **Table 3** for a list of the Administrative Council (AC) members in 1992 and 1993
- Added three additional farmer members to AC in 1993

Administrative Council Meeting:

- AC meeting held in Blacksburg, VA, June 8-10, 1992
- A major project (LS91-37) was visited by the AC
- Quality of Life discussion - Dr. Cornelia Flora, Virginia Tech
- A "Forum" was held, wherein presentations were made to the AC by the following groups, followed by extensive discussion with Council members:
  - National Pork Producers Council
  - Southern Sustainable Agriculture Working Group
  - National Cattlemen's Association
  - American Forestry Council
  - Louisiana Farm Bureau Federation

Review Process

Types of Pre-Proposals submitted:

- Experimental Component
- Integrated Systems
- Strategic Planning

Subject Areas of Pre-Proposals:

- Fish/Wildlife Habitat
- Pollution Prevention
- Biological Depletion
- Conservation Tillage/Crop Residue Management
- Multiple Use of Forage/Grassland Systems
  - wildlife
  - recreation
  - domestic animals
  - water quality

- Agro-Forestry Systems
  - alley cropping
  - grazing livestock under trees
  - hunting leases
- Animal Systems
  - waste management
  - forage utilization
  - multiple grazing systems

Review Process Improved:

- An expanded pool of more than 230 technical reviewers in a variety of expertise areas (see **Attachment A** in the Appendix to Part I for list of areas) was established to help with reviews.

- A Technical Committee consisting of 33 individuals met January 27-29, 1992 in Baton Rouge to evaluate proposals (see **Attachment B**).

- In 1992, a special review committee (**Attachment C**); 52 of those were accepted for further development into full proposals; 11 projects ultimately funded (see **Table 1**).

Types of Projects Currently Active

Of 15 currently active or recently completed SARE projects funded since 1988 for which project profile data are available:

- 11 projects include experimental components;

- 7 are for "educating the educators" (such as Extension);

- 5 contain exploratory components;

- 8 include whole-farm analysis;

- 5 feature whole-farm or ranch demonstration sites;

- 12 will provide accounting budget data on costs and returns for rotations and enterprises; 5 of these will provide data compatible with the Planetor System.

- 4 Extension staff are project coordinators; a total of 52 Extension staff are major participants, and another 47 are cooperators in SARE projects.

Other Council Activities

Continued Development of the "State of the South" Project:

- A strategic planning project involving farmers, universities, private & public entities
  - First planning meeting held May 19, 1992, Atlanta, GA
  - Second planning meeting held August 20, 1992, Atlanta, GA
  - Surveys have been sent out to all county agents (approx 1,400) across the Southern region
  - The survey is being expanded to include farmers, environmentalists, and other categories
  - GIS/Secondary Database Analysis is progressing; additional data from SCS will be provided
  - Fifteen Farmer Focus Groups have been held (as of 2/9/93)
  - Additional information gained at the Extension Conference held March 7-9, 1993 at Callaway Gardens, GA

Conducted Several Site Reviews:

- See **Attachment E** for a list of projects under review and their review teams.

Support of Extension Demonstration Workshop:

- $5,000 committed from FY92 budget
- Held March 7-9, 1993, at Callaway Gardens, Georgia
- Involved a wide cross-section of participants:
  - Producers/farmers
  - Agricultural Professionals
  - Agribusiness Representatives
  - Regulatory & Legislative
  - Consumer/Environmental/Advocacy Groups
  - National & Regional Representatives of Agencies & Organizations

FY 1993 Regional Program Activities to Date

Review Process

Types of Pre-Proposals Submitted:

- Integrated Systems/Whole Farm or Ranch Demonstration Sites
- Experimental Component
- Exploratory Component

Subject Areas of Pre-Proposals:

Same as 1992:

- Fish/Wildlife Habitat
- Pollution Prevention
- Soil Biology
- Conservation Tillage/Crop Residue Management
- Multiple Use of Forage/Grassland/Perennial Polyculture Systems
  - wildlife
  - recreation
  - domestic animals
  - water quality
- Agro-Forestry Systems
  - alley cropping
  - grazing livestock under trees
  - hunting leases
- Animal Systems
  - waste (nutrient) management
  - forage utilization
  - multiple grazing systems

New in 1993:

- Environmentally Sound Multiple Land Uses
  - role & function of Conservation Reserves
  - riparian zones
  - wetlands
  - highly erodible soils
  - windbreaks
  - ground water recharge zones
  - compost or waste application sites

Results of 1993 Pre-Proposal and Proposal Review:

- 208 pre-proposals were reviewed by 5 panels of reviewers (See **Attachment D** for list of reviewers); 45 were selected for development into full proposals, and 11 were funded.
- The technical review process was modified by conducting three peer reviews of each proposal prior to the Technical Committee Meeting
- Technical Committee met February 8-10, 1993 in Baton Rouge
- Eleven proposals funded (see **Table 1).**

Regional Communications Specialist Appointed

- Diana Jerkins took on duties in February 1993
- Duties of the Communications Specialist:
  - Provide assistance to SARE investigators in development and dissemination of information produced as the results of funded programs.
  - Develop, in coordination with regional Project Manager, annual regional reports and assist the national directors in the development of annual reports
  - Identify, in coordination with the southern region AC and national Sustainable Agriculture Network (SAN) Committee, subject areas appropriate for in-depth publications specific to the southern region
  - Represent the southern region along with an AC member on the SAN Committee
  - Assist in developing informational programs and materials for publication such as information sheets, news articles, leaflets, slide presentations, etc.
  - Compile a library of photographic slides of projects
  - Identify and compile a list of individuals, groups, and agencies that would be interested in information pertaining to southern region sustainable agriculture
  - Develop a regional newsletter
  - Plan and coordinate promotional activities and events for the southern region SARE/ACE program

Planning for Transition of Host Institution

- Louisiana State University will complete its role as SARE/ACE host institution in mid-1993
- An alternative host institution and regional coordinator will be identified by May, 1993
- A subcommittee of the AC was appointed to guide transition

APPENDIX TO PART I.

Table of Contents of Appendix

Table 1. Summary List of SARE and ACE Projects Funded in FY1992 AND FY1993

Project #	Title	Project Coordinator	Organization	CSRS Funding	Matching Funds	Duration
ACE 1992						
AS92-1	An Integrated Technological and Marketing Strategy to Make Broiler Production More Sustainable	Miller, Sandra	Winrock International	$200,000	$101,409	3 years
AS92-2	Habitat Enhancement for Beneficial Insects in Vegetable and Fruit Farming Systems	Bachmann, Janet	Rodale Institute	$200,000	$79,975	3 years
AS92-3	Integration of Natural Enemies for Management of the Sweetpotato Whitefly and Associated Disorders on Mixed-Cropped Vegetables	Schuster, David	University of Florida	$170,000	$77,789	2 years
AS92-4	CROPS, The Crop Rotation Planning System, for Whole-Farm Environmental and Economic Planning	Stone, Nicholas	VA Polytechnic Inst. & State U.	$140,000	$88,247	2 years
AS92-5	Effects of Sustainable and Conventional Agriculture on Farm Wildlife	Anderson, J. R.	North Carolina State University	$130,000	$130,100	3 years
SARE 1992						
LS92-45 (AS92-6)*	Use of Organic Nitrogen Sources for Sweetpotatoes: Production Potential and Economic Feasibility	Collins, Wanda	North Carolina State University	$120,000	$50,720	3 years
LS92-46	Development of Cropping Systems for Nematode Management on Agronomic and Horticultural Crops	Dickson, D. W.	University of Florida	$155,000	$184,350	3 years
LS92-47	Farm Scale Evaluation of Alternative Cotton Production Systems	Lyle, William M.	Texas A&M University	$ 60,000	$112,300	1 year
LS92-48	Developing Environmentally Sound Poultry Litter Management Practices for Sustainable Cropping Systems	Earhart, D. R.	Texas A&M University	$140,000	$116,669	3 years
LS92-49	Organic Soil Amendments of Agricultural By-Products for Vegetable Production Systems in the Mississippi Delta Region	Teague, Tina G.	Arkansas State University	$140,000	$64,579	3 years
LS92-50**	Participatory Assessment for Strategic Planning in Sustainable Agriculture Research and Education	Worstell, Jim	Community Farm Alliance (KY)	$37,500	$55,500	3 years
FY1992 Totals				$1,492,500	$1,061,638	

* Will begin as SARE project LS92-45 for a duration of 31.5 months; then continue as ACE project AS92-6 for the remaining 4.5 months. SARE Funds: $105,000, Matching: $44,126; ACE Funds: $15,000, ACE Matching: $6,594.

** A three-year project; this is the first year's funding and matching contribution.

Summary List Of SARE And ACE Projects Funded In FY1992 And FY1993 (Cont.)

Project #	Title	Project Coordinator	Organization	CSRS Funding	Matching Funds	Duration
ACE 1993						
AS93-7	Evaluation of Recycled Paper Mulch as an Alternative to Black Plastic Mulch in Vegetable Horticulture	Schonbeck, Mark	VA Assoc. for Biological Farming	$40,000	$10,100	2 years
AS93-8	Development of Sustainable Area-Wide Weed Management Practices for Improved Land Utilization	Grant, Jerome	University of Tennessee	$165,000	$133,000	3 years
AS93-9 (LS93-56)	Using Soldier Flies as a Manure Management Tool for Volume Reduction, House Fly Control and Feedstuff Production	Sheppard, D. Craig	University of Georgia	$51,250	$12,813	2 years
AS93-10 Continue of (LS91-39)	Use of Poultry Litter as a Soil Amendment in Southern Row Crop Agriculture: A Feasibility Study Based on Agronomic, Environmental, and Economic Factors	Miller, David M.	University of Arkansas	$100,000	$64,043	1 year
AS93-11	Use of Poultry Litter or Manure for Root-Knot Nematode Management on Vegetables and Field Crops	Fortnum, Bruce A.	Clemson University	$99,900	$81,000	2 years
SARE 1993						
LS93-51	Warm-Season Forage Grasses as Rotations for Sustaining Profitable Peanut Production	Rodriguez-Kabana, Rodrigo	Auburn University	$183,000	$48,500	2 years
LS93-52	Utilization of Dairy Manure in Low-Input, Conservation Tillage Animal Feed Production Systems	Mullen, Michael	University of Tennessee	$90,635	$36,123	3 years
LS93-53	Sustainable Whole Farm Grain/Silage Production Systems for the Southeast	Reeves, D. Wayne	Auburn University	$ 240,639	$ 218,600	3 years
LS93-54	Evaluation of Low-Input, No-Till, No-Herbicide Continuous Grazing System for Dairy Cows	Bertrand, Jean A.	Clemson University	$118,911	$62,700	3 years
LS93-55	Cover Crop Integration into Conservation Production Systems for Cotton and Sorghum	Dabney, Seth	USDA/ARS (Mississippi)	$135,540	$117,040	3 years
LS91-40.1	Utilization of Winter Legume Cover Crops for Pest and Fertility Management in Cotton	Rothrock, Craig	University of Arkansas	$104,000	$89,280	1 year
LS92-50.1	Participatory Assessment for Strategic Planning in Sustainable Agriculture Research and Education	Worstell, Jim	Community Farm Alliance (KY)	$90,550	$57,313	3 years
FY1993 Totals				$1,419,425	$930,512	

AS93-9: ACE Funds: $49,100, Matching Funds: $12,300; As LS93-56: SARE $2,150, Matching $513.

Table 2. Distribution of *SARE* and *ACE* Funds by State in the Southern Region

SARE Funds:

State	New 1992		Total, 1988-92	
	SARE	Match	SARE	Match
Alabama				
Auburn University	$64,500	$53,850	$153,376	$208,674
Tuskegee University	22,000	---	22,000	---
State Total	86,500	53,850	175,376	208,674
Arkansas				
University of Arkansas	---	---	510,174	794,187
University of Arkansas/Pine Bluff	23,414	9,142	23,414	9,142
University of Arkansas Extension	8,500	11,987	8,500	11,987
Arkansas State University	93,287	39,145	93,287	39,145
AR Assn. of Conservation Districts	---	---	15,000	38,600
Winrock International	---	---	71,900	180,076
Rodale Inst./Fayetteville	8,349	2,505	8,349	2,505
ACT Farmers	4,350	1,800	4,350	1,800
State Total	137,900	64,579	734,974	1,077,442
Florida				
University of Florida	90,500	130,500	197,470	346,288
Georgia				
University of Georgia	13,500	---	799,803	1,963,116
USDA/ARS	---	---	148,044	397,000
State Total	13,500	---	947,847	2,360,116
Kentucky				
University of Kentucky	11,000	12,000	11,000	12,000
Community Farm Alliance	8,000	8,500	8,000	8,500
Non-Profit Farmer Groups Across South - through CFA	5,000	35,000	5,000	35,000
State Total	24,000	55,500	24,000	55,500

SARE FUNDS BY STATE IN THE SOUTHERN REGION

SARE Funds:

State	New 1992		Total, 1988-92	
	SARE	Match	SARE	Match
Louisiana				
Southern University	---	---	100,000	73,000
Louisiana State University	---	---	15,000	23,396
State Total	---	---	115,000	96,396
Mississippi				
Mississippi State University	600	---	130,350	357,963
North Carolina				
North Carolina State University	98,000	50,720	471,345	753,249
North Carolina A&T State Univ.	---	---	5,000	---
Carolina Farm Stewardship Assn.	---	---	115,000	105,500
State Total	98,000	50,720	591,345	858,749
Oklahoma				
Oklahoma State University	26,782	20,810	326,482	231,162
Kerr Center for Sustainable Ag	---	---	16,500	9,250
State Total	26,782	20,810	342,982	240,412
South Carolina				
Clemson University	---	---	120,000	323,878
Tennessee				
University of Tennessee	---	---	83,000	136,495
Tennessee State University	---	---	5,000	---
State Total	---	---	88,000	136,495

SARE FUNDS BY STATE IN THE SOUTHERN REGION

SARE Funds:

State	New 1992		Total, 1988-92	
	SARE	Match	SARE	Match
Texas				
Texas Ag Experiment Station	173,218	135,159	253,218	216,356
Texas Coop. Extension Service	---	---	25,200	22,750
Texas Dept. of Agriculture	---	---	22,900	16,500
La Mesa Cotton Growers	---	73,000	---	73,000
Prairie View A&M University	---	---	90,000	40,345
State Total	173,218	208,159	391,318	368,951
Virginia				
Virginia Tech	1,500	---	501,500	448,352
Virginia State University	---	---	5,000	---
State Total	1,500		506,500	448,352
Minnesota				
University of Minnesota	---	---	12,500	20,000
Totals, SARE Funds	$652,500	$584,118	$4,377,662	$6,899,216

ACE Funds:

State	1992 (First year of funding)	
	ACE	Match
Alabama		
Auburn University	$12,655	$11,380
Arkansas		
University of Arkansas	12,000	---
University of Arkansas Extension	17,500	7,500
Arkansas State University	33,200	11,380
Winrock International	84,942	143,182
Rodale Inst./Fayetteville	27,080	11,380
SCS/Little Rock	73,558	---
Arkansas Delta Council	4,000	1,000
Arkansas Farmers	29,858	16,518
State Total	282,138	190,960
Florida		
University of Florida	118,310	65,553
North Carolina		
North Carolina State University	145,000	46,915
Oklahoma		
Oklahoma State University	43,725	11,380
Oklahoma Cooperative Extension	8,000	---
Kerr Center for Sustainable Ag	23,625	1,420
Oklahoma Farmers	29,857	16,517
State Total	105,207	29,317

State	1992 (First year of funding)	
	ACE	Match
Texas		
Texas Ag Experiment Station	48,944	12,236
Hitchcock Farms	2,746	---
State Total	51,690	12,236
Virginia		
Virginia Tech	140,000	88,247
Totals, ACE Funds	$855,000	$444,608

Table 3. Southern Region SARE Administrative Council 1992 and/or 1993

Name and Address:	Representing:	Appointing Authority:
Dr. J. Neil Rutger (1992 and 1993) Associate Director ARS Mid South Area P.O. Box 225 Stoneville, MS 38776	Agricultural Research Service - USDA	Administrator Agricultural Research Service - USDA
Dr. George Bird (1992 and 1993) USDA - CSRS 901 D Street, S.W. Aerospace Building, Suite 342 Washington, DC 20250-220	(SARE Director) Cooperative State Research Service - USDA	Administrator, Cooperative State Research Service - USDA
Dr. Dixon Hubbard (1992) USDA/ES Room 3334, South Agriculture Bldg. Washington, DC 20250	Cooperative Extension Service - USDA	Administrator Cooperative Extension Service - USDA
Dr. Raymond E. Campbell (1992 and 1993) Oklahoma State University Interim Associate Director, Extension 139 Ag Hall Stillwater, OK 74078-0500	Cooperative Extension Service 1862 Institutions	Southern Association of Cooperative Extension Service Directors
Dr. Gerald Jubb College of Ag & Life Sciences 104 Hutcheson Hall Virginia Tech Blacksburg, VA 24061-0402	Agricultural Experiment Stations - 1862 Institutions	Southern Association of Agricultural Experiment Station Directors
Dr. Paul Larson (1992) USDA/SCS South National Technical Center Fort Worth, TX 76115	Soil Conservation Service - USDA	Administrator Soil Conservation Service - USDA
Dr. Harry Wells (1992 and 1993) EPA Pollution Prevention Office 401 M Street S.W., MC 7409 Washington, DC 20460	Environmental Protection Agency	Administrator Environmental Protection Agency
Mr. Bob Odom (1992 and 1993) Commissioner of Agriculture Louisiana Dept. of Agriculture and Forestry P.O. Box 631 Baton Rouge, LA 70821	State Departments of Agriculture	Southern Region Association of State Departments of Agriculture
Mr. James Horne (1992 and 1993) Kerr Center for Sustainable Agriculture, Inc. Box 588 Poteau, OK 74953	Non-Profit Organizations	Administrative Council
Mr. John Charles Wilson (1992 and 1993) 1414 Wilson Lane Arlington, TN 38002	Farmer/Producers	Administrative Council
Dr. Noble Usherwood (1992 and 1993) Potash and Phosphate Institute 655 Engineering Drive, Suite 110 Norcross, GA 30092-2821	Agribusiness	Administrative Council

Mr. Darwin Knochenmus (1992 and 1993) District Chief (Retired from USGS, Jan '93) Water Resources Division U.S. Geological Survey 4584 Cooper Lane Jackson, LA 70748	U.S. Geological Survey	Regional Hydrologist, Southeastern Region Water Resources Division
Dr. Rufus Jones (1992 and 1993) Research Director and 1890 Administration Lincoln University 900 Moreau Drive Jefferson City, MO 65101	1890 Extension	1890 Extension Directors
Dr. Charles Panton (1992 and 1993) Associate Dean for Research North Carolina A&T State University 1601 E. Market St. Greensboro, NC 27411-1011	1890 Research	1890 Research Directors
Dr. William H. Brown (1992 and 1993) Associate Director Louisiana Agricultural Experiment Station P.O. Box 25055 Baton Rouge, LA 70894-5055	Southern Region Coordinator	Administrative Council
Dr. Marc Safley (1992 and 1993) USDA/SCS PO Box 2890 Washington, DC 20013	Soil Conservation Service - USDA	Administrator Soil Conservation Service - USDA
Mr. Tom Trantham (1992 and 1993) 330 McKelvey Road Pelzer, SC 29669	Farmer/Producers	Administrative Council
Mr. Rick Kocurek (1992 and 1993) 908 Valley View Robstown, TX 78380	Farmer/Producers (ICM)	Administrative Council
Mr. Walter Rowden (1992 and 1993) Winrock Farms RR 3, Box 386 Morrilton, AR 72110-9539	Farmer/Producers (IRM)	Administrative Council

Attachment A. Areas of Technical Reviewer Expertise

Agronomy (Forage Crops)
Agronomy (Agronomic Crops)
Agronomy (Soil Fertility)
Agronomy (Conservation Tillage)
Agricultural Economics
Agricultural Engineering (Waste Management)
Agricultural Engineering (Soil/Water Conservation)
Entomology (Agronomic Crops)
Entomology (Horticultural Crops)
Plant Pathology (Agronomic Crops)
Plant Pathology (Horticultural Crops)
Nematology
Horticulture (Vegetable Crops)
Horticulture (Fruit Crops)
Weed Science (Agronomic Crops)
Weed Science (Horticultural Crops)
Human Ecology
Forestry/Agroforestry
Fish Habitat/Stream Quality
Wildlife Habitat
Animal Science (Production)
Poultry Science (Production)
Dairy Science (Production)
Rural Sociology
Statisitics

Attachment B. Technical Committee Members, 1992 and 1993
Southern Region SARE/ACE Program

F.E. Busby (1992)
Winrock International
Petit Jean Mountain
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Andy Kegley (1992)
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Ozark Small Farm Viability Project
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1992 and 1993 TC Members (Cont.)

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Stillwater, OK 74078

J.E. Albrecht (1992)
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R.C. Fluck (1992)
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Sam Chapman (1992 and 1993)
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New TC Members in 1993:

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Winrock International
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Attachment C. 1992 Pre-Proposal Review Committee
Southern Region
Sustainable Agriculture Research and Education Program

CATEGORY I: Experimental Component Projects

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Ag Economist
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Gainesville, FL 32611

Attachment D. 1993 SARE/ACE Pre-Proposal Review Panels

PANEL 1	PANEL 2	PANEL 3	PANEL 4	PANEL 5
Wade Howell Jennings, FL Farmer	Jim Joyner Liberty, TN Farmer	Gene Turpin Lebanon, KY Farmer	Dan Gill Remlik, VA Farmer	Janet Bachman Fayetteville, AR Farmer
Dr. Don Voth Univ. of Arkansas Ag Economics	Dr. J. Larry Wilson University of Tennessee Fish Habitat	Dr. Jessica Davis-Carter University of Georgia Agronomy	Dr. Keith Yoder Virginia Tech Horticulture	Dr. Marilyn Swisher University of Florida Home Economics
Dr. J. Scott McConnell Univ. of Arkansas @ Monticello Agronomy	Dr. Daniel C. Yoder University of Tennessee Ag Engineering	Dr. G. Larry Newton University of Georgia Animal Science	Dr. Jeffrey Derr Virginia Tech Weed Science	Dr. Kome Onokpise Forestry Florida A&M University
Dr. Darrell L. Rankins, Jr. Auburn University Animal & Dairy Sciences	Dr. George Naderman North Carolina State U. Agronomy	Dr. Bruce Fortnum Clemson University Plant Pathology	Dr. Charles C. Stallings Virginia Tech Dairy Science	Dr. Donald C. Herzog University of Florida Entomology
Dr. Geoffrey W. Zehnder Auburn University Entomology	Dr. Tom Carter North Carolina State U. Poultry Science	Dr. David W. Bradshaw Clemson University Horticulture	Dr. John Sweeten Texas A&M University Ag Engineering	Dr. Joe Noling University of Florida Nematology
Dr. William Moar Auburn University Entomology	Dr. James Duthie Oklahoma State Univ. Plant Pathology	Dr. Harold R. Hurst Mississippi State Univ. Weed Science	Dr. Don Dorsett Texas A&M University Agronomy	Dr. Ron Masters Oklahoma State Univ. Wildlife Habitat

Attachment E. 1991 SARE Project Site Reviews

LS91-31-139: Biological Control and Its Economics in the Southern United States
Duration: 3 years
CSRS Funding: $49,970
Project Coordinator: J.H. Frank, University of Florida, Entomology & Nematology Dept., Bldg. 970, Hull Road, Gainesville, FL 32611-0740. Phone: 904 392-1901, x128

Site Visit Reviewers: G. Jubb, D. Horton
Site Visit Date: October 19, 1992

LS91-32-185: Economically Viable Production of Vegetables in the Southern Region Using Low-Input and Sustainable Techniques: A Database
Duration: 2 years
CSRS Funding: $37,000
Project Coordinator: Mary M. Peet, Box 7609, Dept. of Horticulture, North Carolina State University, Raleigh, NC 27695-7609. Phone: 919 737-3167

Site Visit Reviewers: N. Usherwood, T. Foster, R. Franklin, J. Matthews
Site Visit Date: October 19-20, 1992

LS91-35-20: Improved Nitrogen Use-Efficiency in Cover Crop Based Production Systems
Duration: 3 years
CSRS Funding: $179,992
Project Coordinator: Michael G. Wagger, Dept of Soil Science, Box 7619, North Carolina State University, Raleigh, NC 27695-7619. Phone: 919 515-2655

Site Visit Reviewers: N. Usherwood, T. Foster, R. Franklin, J. Matthews
Site Visit Date: October 19-20, 1992

LS91-36-63: Pest Management and Orchard Floor Management Strategies to Reduce Pesticide and Nitrogen Inputs
Duration: 3 years
CSRS Funding: $150,000
Project Coordinator: Michael W. Smith, Dept. of Horticulture & Landscape Arch., 360 Agricultural Hall, Oklahoma State University, Stillwater, OK 74078-0511. Phone: 405 744-6463

Site Visit Reviewers: J. Spieth, T. Maurer
Site Visit Date: October 5-6, 1992

LS91-37-120: Low Input Crop and Livestock Systems for the Southeastern United States
Duration: 2 years
CSRS Funding: $180,000
Project Coordinator: Vivien Allen, Dept. of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA 24061. Phone: 703 231-9797

Site Visit Reviewers: B. Malone, S. Chapman
Site Review Date: October 27, 1992

LS91-38-53: Developing and Extending Minimum Input Strategies for Weed Control in Agronomic and Horticultural Crops
Duration: 2 years
CSRS Funding: $100,000
Project Coordinator: Ford L. Baldwin, Cooperative Extension Service, University of Arkansas, P.O. Box 391, Little Rock, AR 72203. Phone: 501 671-2221

Site Visit Reviewers: E. Stromberg, J. Langston
Site Visit Date: September 24, 1992

1991 SARE Project Site Reviews, continued

LS91-39-27: Use of Poultry Litter as a Soil Amendment in Southern Row Crop Agriculture: A Feasibility Study Based on Agronomic, Environmental, and Economic Factors
Duration: 2 years
CSRS Funding: $200,000 (FY91 and FY92)
Project Coordinator: David M. Miller, Agronomy Department, University of Arkansas, Fayetteville, AR 72701. Phone: 501 575-5747

Site Visit Reviewers: N. Rutger, D. Earhart, C. Johnson, D. Howard
Site Visit Date: November 12-13, 1992

LS91-40-44: Utilization of Winter Legume Cover Crops for Pest and Fertility Management in Cotton
Duration: 2 years
CSRS Funding: $200,000 (FY91 and FY92)
Project Coordinator: C.S. Rothrock, Department of Plant Pathology, PS-217, University of Arkansas, Fayetteville, AR 72701. Phone: 501 575-6687

Site Visit Reviewers: N. Rutger, D. Earhart, C. Johnson, D. Howard
Site Visit Date: November 12-13, 1992

LS91-41-43: Uniform Spray Deposits for Reduced Pesticide Use in Weed and Insect Control Operations
Duration: 1 year
CSRS Funding: $43,500
Project Coordinator: David R. Shaw, Dept. of Plant Pathology & Weed Sci., P.O. Drawer PG, Mississippi State University, Mississippi State, MS 39762. Phone: 601 325-2596

Site Visit Reviewers: R. Campbell, E. Eastin
Site Visit Date: December 15-16, 1992

*NOTE: **Site reviews of the 1992 projects will be conducted in 1993 by the new host institution; plans have not yet been made for these reviews. The 1993 projects will be reviewed in 1994.***

PART II. SARE PROJECTS FUNDED IN THE SOUTHERN REGION, 1988 TO 1993

The following are descriptions of all the Northeast Region LISA and subsequently SARE projects funded from 1988 through 1993, including results form the progress reports received in 1992.

Table of Contents of PART II

LS88-1: LOW-INPUT AND ORGANIC PEST MANAGEMENT FOR APPLES AND PEACHES USING MATING DISRUPTION AND GROUND COVER MANAGEMENT

Final Report

Major Participants:

University of Georgia: F.F. Hendrix (Project Coordinator), Plant Pathology, Professor of Peach and Apple Disease, University of Georgia, Athens, GA 30602. Don Horton, Entomology, Georgia Extension Service; Norman McGlohon, Plant Pathology, Georgia Extension Service.

Virginia Polytechnic Institute and State University: Douglas Pfeiffer, Entomology; Richard P. Marini, Horticulture; Jeffrey F. Derr, Weed Science.

Mary Washington College: Joella C. Killiam, Biological Sciences.

Overview

In view of consumer alarm over pesticide residues on fruits, a team of scientists (led by Dan Horton and Floyd Hendrix in Georgia and Douglas Pfeiffer in Virginia) have developed alternative methods of controlling fungus diseases and insect pests. Instead of relying on heavy preventive spraying to control the fungus diseases called sooty blotch and flyspeck, these scientists have developed post-harvest techniques for dipping the fruit in a household chlorine bleach solution. The concentration of sodium hypochlorite (the active ingredient in household bleach) found to be 94% effective in removing sooty blotch from fruit (post-harvest) is 500 parts per million if the fruit is just dipped, 200 ppm if the fruit is dipped and brushed. While 94% reduction is considered successful, a dip with 940 ppm achieved a 100% reduction. The chlorine volatilizes rapidly, leaving no residue. This ingredient is exempted from food tolerances by EPA due to its low risk. In addition, a 500 ppm dip completely removed the residue of fungicides Captan and Maneb, and removed all but 0.2 ppm of Phosmet.

These scientists have also found that most major post-bloom insect pests are effectively controlled by pheromone mating disruption plus a single well-timed spray. This method involves tying to the branches of the trees hundreds of little "twisties" that emit a certain pheromone or a mating attractant, similar to the chemical given off by the female at mating time. Males become completely confused. They fly throughout the orchard trying to find the females. It disrupts the whole reproductive process, and greatly reduces the population of the pest.

In addition to mating disruption, alternate-row spraying and ground cover management help conserve natural enemies of the pests and reduce the number of sprays for peaches. The alternate row spraying technique developed for peaches resulted in 10-25% savings in spray costs.

The overall SARE pest control system developed in this study achieves equal or better control of insect and disease injury as compared with standard practices. Apple growers using the IPM/Scouting program were able to reduce spraying and pesticide costs by about 50% The number of sprays is reduced from 19 per season to an average of 9.5, thereby reducing the pest control costs from $247 per acre to $99 per acre, with no reduction in yield. Profit is significantly increasing.

Objectives

(1) To reduce spraying of apples for pest control.

(2) To implement IPM programs in peach production.

(3) Control coding moth and variegated leafroller through mating disruption achieved by pheromone permeation.

(4) Determine ground cover management practices, contrasting conventional and biological farmers, and effects on the mite system, tree growth and yield.

(5) Determine toxicity of a broad range of herbicides to *Neoseiulus fallacis* (Garman).

(6) Disseminate to conventional and organic growers the current information on reduced pesticide input and organic pest management systems.

(7) Develop new methods for controlling pests using reduced input and organic techniques.

Resource Development

The researchers have published 11 articles or book chapters on pest management for peaches and apples. Over 2600 farmers have been introduced to and adopted the developed IPM techniques presented at workshops or conferences.

Project Duration: Two years (June 1, 1988 - May 31, 1990)

Funding: $100,000 in 1988. Matching, $223,882.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$50,000	$223,882
VPI	$50,000	--
Totals	$100,000	$223,882

LS88-2: WHOLE-FARM LOW/REDUCED INPUT FARMING SYSTEMS AND EDUCATIONAL PROGRAM

Final Report

Major Participants:

Prairie View A & M University: Hoover Carden (Project Coordinator), Administrator of Cooperative Extension Service, Prairie View A & M University, Agriculture Extension Program, Prairie View, TX 77446. Alden Reines, Director, Cooperative Research Center; Alfred Wade, Asst. Adm., Cooperative Extension Program; Bennie L. Lockett, Asst. Adm., Cooperative Extension Program; Terry Menges, Cooperative Extension Program; Arthur Mangaroo, Cooperative Research Center; Juanito Reyes, Cooperative Research Center; Billy Higginbotham, Cooperative Extension Program.

Texas A & M University: Garland McIlveen, Agricultural Extension.

Texas Department of Agriculture: Gus Townes, Marketing Director, Austin, Texas.

Farmer Participation:

Maurice Owens, Waller County, Texas; Ralph Lindsey, Cherokee County, Texas; Perry Leutge, Milam County, Texas.

Overview

Most small farmers are producing only one or two major enterprises, without choosing among efficient and profitable alternatives. Most farmers fail to take the time to analyze the potential profitability that can be gained through adoption of low/reduced input agricultural concepts. There exists a need for a comprehensive resource management program designed to address these issues in which the generated data are documented through research/demonstration, in a realistic production situation, i.e., on the farm.

This project will consist of a coordinated multi-agency effort in providing educational and technical assistance to Texas farmers through the implementation to whole-farm low- or reduced-input agricultural research and demonstrations, both on the Prairie View A & M campus and within two hundred miles of campus through field days, seminars, staff training and clientele workshops.

This project will include comprehensive investigations into reducing farmer reliance on off-farm purchased inputs, thereby minimizing environmental impacts, while maintaining productivity through soil management, conservation and utilization of natural resources in improved farming systems.

Project Results

Agronomic and Horticultural Component

Wheat, oats and rye in combination with watermelons were used in this study to evaluate windbreak, allelopathic effects, soil diseases and weed control. By screening and selecting crops for their control and/or resistance to primary pests would limit pesticide applications, thus reducing off-farm purchased inputs. Results from these studies indicate that there was no measurable effect of allelochemicals on melon development and weed suppression. Variables tested showed no differences except in one instance where the number of melons significantly exceeded that of the control. The use of fertilizer was the same as that under conventional usage, except in combination with clover. In the latter, fertilizer rates were reduced. No pesticides were used to control weed, disease and insect pests in the melons grown under the wheat, oats and rye treatments. No cultivation took place after seedbed preparation except in the control plots. Yields at one low input site were lower than what is normally expected. This reduction in yield was not attributed to low input practices, but to a large number of pollinators being mixed in with the plants (seedless watermelons) in each plot. Reduced pesticide applications and reduced tillage operations, and multiple use of plots produced a corresponding reduction in off-farm purchased items and an increase in savings.

Wildlife and Fisheries Component

Several low input sustainable agriculture projects relative to wildlife and fisheries were evaluated. Since many small landowners own or control numerous farm ponds and timberland, several demonstrations were established in order to depict low input production opportunities to produce fish for increased farm nutrition and income and to manage game species for increased income through leasing.

Cage catfish demonstrations were established to show how landowners with farm pond or reservoir resources that were not suitable for fish production and harvest by conventional methods could raise fish. In addition to cage production, pond catfish production demonstrations were also established.

Channel catfish production in existing farm ponds is an excellent low input technique for increasing farm recreation, nutritional and income. Landowners with ponds that are harvestable by seining are encouraged to consider the use of these underutilized resources for catfish production to provide an additional source of income from their farms.

FISH PRODUCTION

A sample of catfish was taken from the ponds. Average size of the catfish ranged from 1.1 pounds to 2.1 pounds and 2.6 pounds, depending on the pond. In 1990, one pond in Waller County produced an estimated 165 pounds of edible size channel catfish, and in 1991, that same pond produced 127 pounds of edible size catfish. The second pond site produced 215 pounds. This rate of production equals the 1000 pounds per surface acre achieved in previous demonstrations. The 0.25 surface acre pond in Smith County produced an estimated

388 pounds of edible size catfish, and the 1.0 surface acre in Nacogdoches County produced 935 pounds.

CAGED CATFISH PRODUCTION

A pond approximately 7 surface acres was selected for the site of this demonstration. A 4x4x4 plastic mesh covered cage was placed in the pond and stocked with 430 channel catfish fingerlings 6 to 8 inches in length. The cage was supported in the pond by styrofoam floats. Cost of the fish was $0.40 per fish for an initial stocking expense of $172.00. Fish were fed on a daily basis with 36% floating caged catfish ration. During the first 10 days, fish were treated with terramycin to prevent the onset of disease.

After 198 days of feeding, fish were harvested. A total of 261 fish were processed with a live weight of 210 pounds; dressed weight, 119 pounds. Weights ranged from 4 pounds to 0.75 pounds. Eighty fish, averaging 0.3 pounds were returned to the pond for an additional 24 pounds of fish. Three hundred and forty one fish were recovered from the cage, a 79.30% survival rate. The fish consumed 331 pounds of feed, for a total cost of $85.73.

Catfish can be grown in caged culture but require more intensive management and care. The potential for stress and death loss is much higher than in an open water environment.

Several factors are to be considered in the evaluation of this demonstration. Compared to earlier data, the results from these studies were not favorable. Lost per pound dressed weight in 1990 was $2.19 per pound as compared to $1.23 and $1.57 in previous studies. This higher cost can be attributed to lower stocking rates, poorer food conversion, higher feed costs, health problems and a lack of management skills on the part of the cooperator.

Cool Season Forages for White-tailed Deer

Winter forage plantings to supplement wildlife food sources can be evaluated based upon a number of criteria. These include pounds of forage produced per acre, crude protein content during the utilization period, cost of production, response to extremes of weather and grazing pressure. Two forage strategies were tested: oats/rye/Austrian winter peas (AWP) and AWP alone. Differences were noted in total production (pounds/acre), crude protein content, animal preference, cost of production and response to weather conditions. Recommendations for winter planting would lend themselves to a combination of AWP, oats, and rye. A forage strategy of oats for early grazing with resultant concentration of deer for hunting and rye for cold weather tolerance and AWP for a 8 to 9 month grazing program (that also returns nitrogen to the soil) should prove successful in East Texas.

Austrian winter peas were evaluated alone and in combination with Bob oats and Elbon rye. AWP did not greatly contribute to the performance of the oats/rye/AWP combination. Quality of AWP (as measured by crude protein) established alone was excellent, however, yields (lbs/acre) were lower due to reduced cold tolerance.

Warm Season Supplemental Forage for White Tailed Deer

A demonstration was established on the Ray Farm near Frankston to evaluate the performance of Iron and Clay cowpeas (seeding rates of 25.0 and 37.5 lbs/acre) planted in combination with alyceclover (seeding rate of 20.0 lbs/acre) and Laredo soybeans (seeding rates of 25.0 and 37.5 lbs/acre) planted in combination with alyceclover (seeding rate of 20.0 lbs/acre). Combination plots were established in a random block design on a bottomland site to determine: (1) adaptability and yield differences between cowpeas and soybeans planted at various seeding rates with alyceclover (2) acceptance of forages by deer and (3) nutritive quality.

A supplemental forage combination of Iron and Clay cowpeas and alyceclover seeded at the rates of 37.5 and 20.0 lbs/acre respectively, ranked first among the various treatments tested. This combination produced the most dry weight forage (7263.3 lbs/acre standing crop) and tested similar to the nutritive value (crude protein, acid detergent fiber and total digestible nutrients) of other forage combinations. Utilization of alyceclover remained low throughout the study but utilization of soybeans within 30 days of planting led to their elimination from test plots. Heavy utilization of cowpeas was not evident until late September, approximately 4 months after demonstration establishment.

Corn Earworm Research

Corn producers nationwide have yearned for years for worm-free corn ears. Sweet corn is one of the more popular vegetables grown in the United States. It currently ranks second in farm value for processing and fourth for fresh market among vegetable crops. In 1988, Texas farmers produced 3,000 acres of sweet corn with an average yield of 5,000 pounds per acre and a total market value of $2.1 million.

1989 Results

Losses from corn earworm infestation among the 20 varieties tested ranged from 9.2% (Sweet Belle) to 0.9% (Seneca Sentry). Two varieties, Seneca Sentry and Jubilee (1.5% damage), exhibited corn earworm damage of less than 2%. Losses of less than 2% of the potential marketable ears are both economically and environmentally favorable. This is significant, considering that up to 21 or more applications of pesticides may be required to obtain the same or greater levels of protection on a more susceptible variety.

When evaluated and ranked according to the actual number of ears absent of insect damage, Seneca Sentry and Jubilee showed the greatest resistance to corn earworm infestation with seven times (7x) less damage than Merit, the susceptible check variety. These varieties were followed closely by Supersweet 7620, Calico Belle, Phenomenal and Show Case which exhibited two to three (2x-3x) less damage than Merit.

1990 Results

Mean losses per ear from corn earworm infestation among the 19 varieties tested ranged from 0.0444 ins. (Seneca Sentry) to 0.3038 ins. (How Sweet It Is). Seneca Sentry

exhibited the least damage of field trials evaluated in 1989. Thus, the ranking of the five varieties showing the least ear damage (0.0444 to 0.1784) are Seneca Sentry, Trucker Yellow, Golden Queen, Silver Queen and Golden Cross Ban. It is recommended that these varieties be included with the screening of new varieties that have not yet been studied.

Results contribute to needed information necessary to educate corn producers on alternatives for minimizing pesticide usage. Plans are underway to train and disseminate this and other supportive information to sweet corn producers. However, the results of this study are preliminary at best since there are numerous varieties of sweet corn yet to be screened. By utilizing these results and screening them against existing and future varieties, hopefully, farmers will be able to choose among a host of resistant varieties that are best suited to their particular locale.

Whole Farm Project

This phase of the project was initiated in the fall of 1988 to investigate the feasibility of implementing a total (whole) resource utilization and management program for small farmers. As a part of this initiative, demonstrations addressing low/reduced input farming practices was implemented. Projects included intercropping systems, soil management practices and specialty crops. Crop resistance to common pests that may be prevalent in the aforementioned cropping systems was also investigated and demonstrated as well as spray solution pH on the effectiveness of various chemicals. The objective of the latter was to reduce pesticide applications where use was necessary.

After small farm cooperators were selected, plans were laid out and implemented in a total approach to Whole Farm planning. Overall, six areas were chosen for implementation. These included: beef production, forage production, orchard and vineyard production and management, vegetables, field crops and fish production.

After renovation of ponds at the Falls County site, each was stocked according to recommendations with catfish fingerlings and fed accordingly, using a 32% protein ration. Ponds were harvested and relevant data collected. This data will be used in developing the software package. A multi-purpose pond (catfish production, irrigation and livestock watering) was constructed at the Smith County site. The pond measures 80' x 100' and was completed in July, 1989. The pond was stocked with 200 catfish fingerlings in April 1990, after being limed according to recommendations. There were no ponds at the Milam County site, but one does exist which might be renovated, stocked and used for recreational fishing.

Pesticide spray and fertilizer application schedules were developed, employing low input practices. Horticultural and agronomic crops were planted according to plans developed, harvested and needed date recorded. Yields were good except for those vegetables grown in one area which was not limed according to recommendations. Drip irrigation and mulching were employed at the Falls County site. Fourteen peach trees were lost from the first year planting. Those remaining were pruned and sprayed as outlined in the schedule. Details of the schedule are on file at headquarters (PVAMU), and copies are also on file with the cooperator(s) and program aide(s). Data, with explanations, were collected for each entity,

assembled chronologically and placed in categories for easy reference. This data is also being used in the development of the software package.

A six-acre Coastal Bermuda pasture was established; four-acre bahia grass stand improved and cell grazing was implemented on bahia grass. This was part of an overall plan to improve the small beef cattle herd and maximize pasture usage. Herd improvement included establishing a breeding cycle for fall calving, herd culling and the selling of the bull. A fencing program was also implemented to maximize production and utilization of the land.

The 95 fruit trees planted in year-one were pruned, fertilized and sprayed according to schedule. Fourteen of the 95 trees were lost. The original 34 trees did not produce in year-one, but yields were high, especially peach, for the second year. The pea-peach and watermelon-peach, intercropping systems did well, as did the sweet potatoes, corn and peanuts. Yields from all crops ranged from average to good.

A fertility and liming schedule was established for the vegetable crops and the cooperator(s) was taught proper sprayer calibration. Soil tests were made. Sweet corn, tomatoes, peppers, onions, peanuts, sweet potatoes, melons and field corn were some of the plants grown at the sites. Only melons were grown at the Milam County site in addition to wheat.

In our efforts to develop, identify and teach techniques that will enable small farm producers in Texas to diversify and reduce off-farm purchased inputs, three farm sites were established, and are now being used as Model Farms to promulgate these concepts. A fourth farm site is under consideration or development into a whole farm site. Now that the sites have been established, monitoring and instructing the cooperators, and clientele will continue in record keeping, recommended horticultural, agronomic, beef cattle and fisheries practices.

A total of eight field days and training sessions have been held. Two sessions were held at headquarters, the others at the Whole Farm sites. The May and June field day activities in 1990 and 1991, held at the Smith County Whole Farm site, involved 62 and 53 participants respectively. Low input practices were emphasized at all field day activities, as well as record keeping and marketing strategies.

Objectives

(1) Implement research projects addressing "low/reduced input" farm resource management practices. Projects will include crop rotation, intercropping systems, soil management practices, specialty crops (oriental vegetables, low-chill apples, etc.) and reduced levels of fertilizers in combination with legumes and cover crops.

(2) Investigate crop resistance to common pests that may be prevalent in this type of farming system.

(3) Investigate the affect of spray solution pH on the efficacy of various common chemicals in an attempt to reduce pesticide applications where use is necessary.

(4) Implement small-farm, whole-farm demonstrations in various geographic areas across Texas to evaluate low/reduced input resource utilization and conservation systems.

(5) Assist small-scale farm producers in analyzing existing operations and identifying potential areas for improvement in resource utilization and conservation. This will include such areas as farm pond management, Christmas tree production on non-producing land areas, and evaluation of the potential for wildlife management for profit.

(6) Develop and evaluate strategies and materials necessary for converting from high input to low/reduced input farming systems.

(7) Make available technical assistance to aid producers and Cooperative Extension personnel in understanding, disseminating and adapting the technology from the data base generated in this project.

Project Duration: Three years (June 1, 1988-May 31, 1991)

Funding: $90,000 in 1988. Matching, $40,345.

Organization	Sustainable Agri. Funds	Matching Funds
Prairie View A & M University	$90,000	$40,345
Totals	$90,000	$40,345

LS88-3: PLANNING GRANT: DEVELOPMENT OF LOW-INPUT AGRICULTURAL TECHNOLOGY DEMONSTRATIONS AT THE SUNBELT AGRICULTURAL EXPOSITION DEMONSTRATION FARM

Final Report

Major Participants:

University of Georgia: John Beasley (Project Coordinator), Extension Specialist, Rural Development Center, Department of Agronomy, Tifton, GA 31793. Charles Douglas, Agronomy Department, Coastal Plain Experiment Station.

Overview

A comprehensive approach to the selection, screening and development of demonstrations of low-input agricultural systems. The annual agricultural exposition operates a 540 acre farm, on which over 160 demonstrations are conducted each year. This planning

project will assemble a Council of Advisors comprised of researchers, educators and farmers from eight southeastern states (VA, NC, SC, GA, TN, FL, AL, MS) to identify and screen low-input agricultural technology and systems. Furthermore, this Council of Advisors will provide direction for successful on-farm demonstrations of that technology or those agricultural systems most effective in reducing use of off-farm input resources.

Objectives

(1) Identify research with potential for rapid application to low-input farming systems for southern farmers.

(2) Screen identified research for its relevance to southeastern farming systems and evaluate the research on its ability to be readily adopted by farmers.

(3) Develop demonstration methodologies for application of selected low-input research at the Sunbelt Agricultural Exposition Demonstration Farm.

Project Duration: One Year Planning Grant starting June 1, 1988

Funding: $14,700 in 1988. Matching, $33,900.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$14,700	$33,900
Totals	$14,700	$33,900

LS88-4: PLANNING GRANT: DEVELOPMENT OF A FARMER/EXTENSION/RESEARCH NETWORK AND FARMING SYSTEMS DATA BASES FOR LOW-INPUT AGRICULTURE

Final Report

Major Participants:

Winrock International Institute For Agricultural Development: F.E.Busby, Regional Director, U.S. Frank H. Baker, Regional Director. Robert Havener, President.

University of Arkansas: Ted Jones, Director, Cooperative Extension Service; Gerald Musick, Dean of the College of Agriculture and Director, Agricultural Experiment Station; Ron Johnson, Associate Director, Oklahoma Cooperative Extension Service and Agricultural Experiment Station.

Appropriate Technology Transfer for Rural Areas (ATTRA): Ann Sinclair, Program Manager.

Small Farm and Technical Assistance Center: Corbet Lampkin, Head.

East Arkansas Produce Marketing Association: Leroy S. Lacy, Director.

Heifer Project International: Armin Schmidt, Director of Programs, Global Services.

Ozark Small Farm Viability Project: Gordon Watkins, President.

Meadowcreek Project: Jim Lukens (formerly Agricultural Director; now with ATTRA).

Kerr Center for Sustainable Agriculture: James Horne, Vice President.

Arkansas Land and Farm Development Corporation: Calvin R. King, Executive Director.

Arkansas Land Stewardship Project: Nick Brown, Director.

Arkansas South Central States Representative: Janet Bachmann, Rodale Institute.

International Agricultural Programs: Tom W. Westing, Associate Dean.

Overview

This proposal requests funding for the implementation of a planning process which will develop plans for two major comprehensive project components, or sets of components: 1) a farmer/extension/research network, and 2) necessary data bases concerned with low-input agriculture in Arkansas, Oklahoma and appropriate adjacent areas. The network will serve as a mechanism for communication among farmers, extension workers and researchers and, as such, will be the major mechanism for data accumulation and information dissemination, as well as for identification of high priority research questions.

Data base development will use an analytic inventory of existing data bases and data base methodology to determine how to prepare and store new data bases. A farm management data base focusing upon costs and returns of actual practices in use will be the first developed. The process outlined, which will follow key elements of the Farming Systems Research/Extension approach, represents a cooperative effort of university researchers and extension personnel, farmers and public/private sector organizations, some of whom are already heavily committed to low-input and sustainable agriculture. Lead responsibility for implementing the planning project will be taken by Winrock International Institute for Agricultural Development. Completion of the planning process will result in specific implementation plans for the establishment of the farmer/extension/research network and low-input data bases, as well as the creation of an ongoing planning and coordinating mechanism for low-input research and extension activities in the target region.

Project Results

The Network and Its Accomplishments

The formation of the network began with a meeting in March and continued with monthly meetings throughout the year. Primary accomplishments were:

1. Planned and conducted four meetings of farmers and agency representatives to increase understanding of low input sustainable agriculture (LISA) concepts and to generate ideas and/or obtain inputs concerning high priority needs of research and education on these concepts. The Rodale Institute's regional representative also obtained information about farmer viewpoints through a survey of readers of New Farm Magazine.

2. Planned and conducted a 1-day program focusing on LISA in Arkansas and Oklahoma at the International Farming Systems Research and Extension conference.

3. Obtained information through a survey of Arkansas extension agents by the Extension Service LISA representative; it showed that more than 50% of them need and desire training to improve their ability to counsel with farmers on LISA concepts.

4. Assisted Arkansas Extension Service with an orientation discussion on LISA concepts in the annual extension conference program.

5. Cooperated in a study and development on a profile of farming systems and methodology of the Ozark Region and the Arkansas River Valley Region.

6. Developed and submitted the proposal for a comprehensive 3-year regional LISA project based on the concepts originally offered in the planning proposal.

7. The number of participating organizations and agencies has been expanded from 15 to 20 (it is expected to increase more). The expansion includes the addition of participants from Missouri and Texas.

The Assessment of Databases

In the Arkansas/Oklahoma region, data concerning LISA systems exists in the files and publications of the Agricultural Experiment Stations, the Extension Services, the Private Research and Education Organizations, Agricultural Producers Organizations, and in farmers' files or experiences. The project database subcommittee concluded that optimizing use of the information requires (1) some standardization of recording and storage and (2) development of improved methods of communication for exchanging information. Thus, the comprehensive proposal includes the concept of data storage center(s) using more standardized input formats. The Appropriate Technology Transfer to Rural Areas Center (ATTRA) will provide leadership in development of this concept. A combination of electronic bulletin boards and newsletters

will facilitate information exchange through leadership of Winrock International and the Extension Service. A preliminary characterization and descriptive directory of participating organizations has been drafted as part of the study of farming systems of the region. It will be updated and expanded in the future.

Viewpoint and Characteristics of Farmers

Significant information has been obtained from the four meetings of farmers and agency personnel, the panel discussions at the Arkansas day of the International Farming Systems Research and Extension Conference, the farmer participants of the project committee and subcommittees, and the survey by the Rodale Institute. The farmers responding represented a large array of farm sizes (from less an acre for herb farmers to thousands of acres for row crop and livestock farmers), locations (from the Mississippi River delta near Memphis to the Ozarks of North Arkansas to grazing areas of southeastern Oklahoma), part-time and full-time operations, organic farms, and conventional high input farms. A broad array of commodities were produced on the farms. Farmers expressed the following viewpoints:

1. Primary sources of information: farm magazines, other farmers, farm organizations, extension service and experiment station personnel, fertilizer and feed dealers.

2. LISA-related practices some farmers used: conservation tillage, legumes in rotation, green manure crops, cover crops, water conservation measures, reduced herbicide applications for weed control, animal manure applications, crop rotations, reduced insecticide use, and rotational grazing.

3. Chemical use: most farmers either maintained the same level of use or decreased it, but some increase occurred in the practice of no tillage procedures.

4. Effects of reduced chemical use: increased management and/or labor, increased information needs, yields and net income remained same or increased.

5. Reason for reduced chemical use: concerned about water quality and/or environmental contamination, need to reduce costs.

6. Types of LISA information and/or research needed: weed control, insect control, crop and livestock diseases, soil fertility, water management, alternative crops, farm budgets, marketing, crop and livestock management.

Objectives

(1) Bring together interested organizations, agencies and persons in the region composed of Arkansas, Oklahoma and appropriate adjacent areas to engage in the planning process for the identification, elaboration and development of low-input agricultural techniques and production in the region.

(2) Produce a detailed plan for the cooperative achievement of the above, using a Farming Systems Research/Extension (FSR/E) approach, which emphasizes farmer involvement together with multi-disciplinary and multi-agency collaboration.

(3) Produce:

(a) comprehensive project proposal(s) for multi-year funding, which will be implemented cooperatively by the planning group, and/or by individual agencies or groups from the planning group; and

(b) a mechanism for identifying, prioritizing and funding individual component project phases that are proposed.

Project Duration: One year: June 1, 1988 through May 31, 1989 (Project Completed)

Funding: $15,000. Matching, $34,858.

LS88-5: PLANNING FUNDS FOR A PROPOSAL ON EXTENDING THE ISSUE OF SUSTAINABLE AGRICULTURE TO SMALL FARMS IN NORTH CAROLINA, TENNESSEE AND VIRGINIA

Final Report

Major Participants:

North Carolina A & T State University: M. Ray McKinnie (Project Coordinator), Agricultural and Natural Resources, P.O. Box 21928, Greensboro, NC 27420, Phone: (919) 334-7957, assisted with state conference and primary coordinator for proposal development. Daniel D. Godfrey, Associate Dean & Extension Administrator; John M. O'Sullivan, Greensboro, NC 27411, state conference coordinator, assisted in the development of proposal.

Virginia State University: Clinton V. Turner, Associate Vice President for Agriculture and Extension; Lorenza Lyons, Assistant Extension Administrator, actively involved in development of proposal; Mitchell Patterson, Petersburg, VA 23803, project director (Virginia) and an active participant in proposal development.

Tennessee State University: James E. Farrell, Extension Administrator; Richard J. Winston, project co-director (Tennessee) and an active participant in proposal development; Alvin E. Wade, Nashville, TN 37203.

Overview

The present proposal requests funds to develop a multi-institutional Extension project to promote the use of sustainable agriculture methods on small farms in North Carolina, Tennessee and Virginia. Successful implementation of a sustainable agricultural program in the southern United States will need to include the small and part-time audience which are the traditional audiences of the 1890 Land-Grant universities. Small farmers may not be aware of present research efforts in this area, or of consumer interest in bio-organic low-input vegetables and other commodities. For that matter, Extension professionals and paraprofessionals working with this audience may not know of or be on the cutting edge of present research in sustainable agricultural practices.

Project Results

Initial expenditures were used to involve 1890 state-level Research and Extension staffs in North Carolina, Tennessee and Virginia, and county Extension professionals and paraprofessionals in those states in formulating appropriate ways to achieve the project's goal of extending the issue of low-input sustainable agriculture (LISA) to the 1890 Land-Grant universities and their audiences. To that end, two major objectives were outlined for the project. They were:

Successful implementation of a sustainable agriculture program in the southern United States will need to include the small and part-time audience which is the tradi tional audience of the 1890 land-grant universities. Small farmers and local Extension staffs working with this audience need educational programs and discussion of the issues and terminology involved in order to "buy in". They need to be able to express their views and make suggestions on the appropriate ways of establishing relevant and meaningful programs in sustainable agriculture.

Project participants conducted and/or participated in a series of activities relative to the project's two main objectives. Towards Objective # 1, representatives of North Carolina A & T, Virginia State and Tennessee State attended the International Conference on Sustainable Agricultural Systems held in Columbus, Ohio to better acquaint themselves with the emerging issues of LISA and their implications for small/limited-resource farmers. A visit was also made to the Rodale Research Center in Kutztown, Pennsylvania, to view and discuss agronomic research involving the reduced use of chemical fertilizers, herbicides and pesticides and the increased use of green/animal manures, and conservation tillage practices.

Having armed themselves with information and techniques relative to LISA practices, representatives of the three institutions met face-to-face and corresponded to develop a major multi-state-discipline applied research proposal entitled "The Issue of Low-Input Sustainable Agriculture: Its Relevance, Importance, and Applicability to 1890 Land-Grant University Research and Extension Programs with Small and Limited Resource Farm Operators." The proposal's primary focus was the introduction of low-input agronomic practices, such as soil amendments, green manures and no-till planting, and biological insect control into traditional cultural practices for the production of sweet corn and vegetables. Additionally, the proposal provided for an educational and informational exchange and dissemination effort among 1890

program personnel and their clientele. The proposal was submitted and received some favorable comments. However, due to the highly competitive nature of the review process, funds were granted only to a few select proposals.

Towards completion of Objective # 2, North Carolina A & T and Virginia State universities hosted state conferences that addressed the potential application of LISA technology to the establishment of viable low-input sustainable production systems for small-scale agriculture. North Carolina A & T's state conference, held in March 1989, focused on the issue of LISA, offering an overview of its purpose and intent, site visits to research projects, and production information on the LISA agenda in the areas of water quality, animal/forage production systems, organic vegetable production and biological insect control. The conference agenda was designed to appeal to both professional and paraprofessional Extension workers as well as to other persons interested in LISA.

Virginia State University hosted a state conference in July 1989 entitled "Income Opportunities for Small and Part-Time Farmers Through Ecological Management of Natural Resources." Conference participants were treated to informative talks on shiitake mushroom production, medicinal herbs and dried flowers, ginseng and garlic production and animal/forage production featuring controlled grazing. Additionally, conference participants were given a tour of various agronomic research practices and alternative crops, some involving LISA techniques, being conducted at the university's research farm. Approximately 100 people attended the conference and received up-to-date information on LISA and alternative agricultural enterprises.

Project personnel at Tennessee State University chose not to host a state conference. Instead, the Extension Program provided travel for its specialists, researchers and field staff to attend the state conferences in North Carolina, Virginia and other related conferences and meetings. As a result of their attendance of various conferences and meetings, numerous low-input sustainable agricultural concepts and techniques have been incorporated into ongoing Extension and Research programs which benefit hundreds of small and part-time farmers.

In summary, North Carolina A & T, Virginia State and Tennessee State universities achieved their main objectives and overall goal of extending the issue of low-input sustainable agriculture (LISA) to the 1890 Land-Grant universities and audiences. It is estimated that hundreds of small and part-time farmers, across the three states, have benefitted from their exposure to information and research technologies given out by these universities. This project has had a definite impact on 1890 institutional awareness of the issue of LISA and its application to day-to-day small scale agricultural practices in North Carolina, Virginia and Tennessee.

Objectives

1. Develop a multi-year, multi-discipline extension based program for small and part time farmers in sustainable agriculture endeavors by the 1890 institutions in North Carolina, Tennessee, and Virginia.

2. Hold two planning meetings and a conference in each state to involve interested staff, farmers and other individuals.

Project Duration: One year (June 1, 1988 - May 31, 1989)

Funding: $15,000 in 1988. No matching funds.

Organization	Sustainable Agri. Funds	Matching Funds
Planning Grant	$15,000	--
Totals	$15,000	--

LS88-6: PLANNING GRANT: ON-FARM DEMONSTRATION OF LOW-INPUT FARMING

Final Report

Major Participants: Carolina Farm Stewardship Association: William W. Dow (Project Coordinator), Carolina Farm Stewardship Association, Route 3, Box 333, Pittsboro, NC 27312. Marjorie Bender (Project Manager), CFSA, 115 W. Main Street, Carrboro, NC 27510, 919-968-1030.

Overview

The methods of low-input, sustainable agriculture and the positive results of new research must be successfully demonstrated on actual working farms in order to be widely adopted. A process is needed whereby other farmers interested in changing their practices can see and learn from successful practical applications by farmers like themselves.

This is a proposal for a one-year planning grant to set up a program for on-farm demonstration of low-input agriculture in North Carolina. Farms would be chosen from each region of the state to reflect a diversity of agricultural enterprises, including horticultural crops, agronomic crops, and mixed farming. Because new methods may require new crops and markets or offer the possibility of premium prices, appropriate alternative marketing channels will be researched to assist farmers. An effort will be made to involve Extension personnel and vocational agriculture teachers working in the counties of participating farmers.

Project Results

The proposal developed from this planning grant was accepted as LS 89-14.

Objectives

(1) Plan and begin to implement a program for creating on-farm demonstrations of low-input farming systems at several locations throughout North Carolina. The on-site part of this project will be accompanied and enhanced by marketing and educational components.

(2) Demonstrate methods of facilitating the transition from conventional agriculture to alternative methods through emphasizing the on-farm demonstration of low-input methods, recruiting Extension personnel and Vocational Agriculture teachers for low-input presentations, and identifying consultants to advise the project demonstration and farmers in transitions to low-input agriculture.

(3) Develop a three-year project proposal, in conjunction with the participating farmers and those who have been identified as advisors and consultants.

Project Duration: One year Planning Proposal (August 1, 1988 to July 31, 1989)

Funding: $15,000 in 1988. Matching, $5,500.

Organization	Sustainable Agri. Funds	Matching Funds
Planning Grant	$15,000	$5,500
Totals	$15,000	$5,500

LS88-7: LOW-INPUT REDUCED TILLAGE CROP PRODUCTION SYSTEMS FOR THE SOUTHERN UNITED STATES (88-108-1)

Final Report

Major Participants:

University of Georgia: W.L. Hargrove, Agronomy Department, Georgia Agricultural Experiment Station, University of Georgia, Griffin, GA 30223-1797. J.R. Allison, Agricultural Economics Department, Georgia Agricultural Experiment Station; D.C. Coleman, Institute of Ecology.

Clemson University: J.H. Palmer, Agronomy Department, South Carolina Cooperative Extension Service.

Overview

Reduced tillage potentially can play a key role in sustainable agriculture production systems by reducing soil erosion, decreasing fossil fuel use, decreasing weed pressure through maintenance of surface mulch, and enhancing soil productivity through crop residue and organic matter maintenance. Reduced tillage technologies have not been incorporated into low-input cropping systems. The overall thrust of this project is to develop low-input wheat/soybean/corn production systems which incorporate reduced tillage technologies.

Project Results

Low-input reduced tillage crop production systems can potentially play a key role in sustainable agriculture systems by reducing soil erosion, decreasing fossil fuel use, decreasing weed pressure through maintenance of a surface mulch, and enhancing soil productivity through crop residue and soil organic matter maintenance. The overall objective of this project was to develop low-input reduced tillage crop production strategies appropriate for use in the Southern United States.

Results from this study indicate that low-input reduced tillage technologies can be profitably implemented in the Southern United States under certain conditions. Namely, the intermediate mix of inputs (intermediate N fertilizer in combination with a cover crop, intermediate herbicide use and no-tillage) resulted in yields that were comparable to those obtained using a high (currently recommended) mix of inputs (high N fertilizer, high herbicide use and conventional tillage). Additionally, soil conservation benefits associated with no-tillage and legume cover cropping practices included increased water infiltration, increases in soil organic matter content, and increases in soil organic matter content, and increases in soil microbial activity. Additional findings included: 1) tillage and herbicide use patterns can be modified without greatly affecting foliage-inhabiting arthropod populations in soybeans, 2) the negative effects of shading associated with intercropping soybeans into wheat does not result in yield reductions when the period of overlapping crops is relatively short, 3) reduced herbicide use (postemergence application only) can be adopted in intermediate tillage regimes without significantly reducing yield of soybeans or corn, but results in yield reductions under no-tillage conditions, as compared to high (pre- and postemergence application) herbicide applications, and 4) weed management for intercropping systems may require little or no herbicides if intensive crop management, crop rotation, and crop scouting are practiced.

All of these results were presented at professional meetings, and published in scientific journals and the popular press. Demonstration plots were initiated at six locations in agricultural regions in Georgia and South Carolina. Cumulative attendance at field days exceeded 1000 farmers and other clientele. Four farmers are involved in on-farm demonstrations of interseeding techniques, and one farmer has adopted interseeding technology in his commercial operation. Results were presented in farm journals and other non-scholarly publications to inform farmers of the potential of low-input reduced tillage crop production systems and interseeding technologies.

This study indicates that there are many combinations of factor levels that can produce acceptable yields for crop rotations in the Southern United States. However, the primary requirement for the success of low-input reduced tillage systems is that they must be flexible to account for variations in environmental conditions, and that they must employ various combinations of input factors that are suitable for prevailing conditions. In conclusion, the yield results obtained in this study indicate that tillage, herbicide, and N fertilizer applications by prescription are an anathema to successful sustainable agriculture systems.

Objectives

(1) Evaluate combinations of three levels of three important factors in sustainable, low-input production systems, namely tillage, nitrogen fertilizer, and herbicides.

(2) Determine the profitability of the systems evaluated in the field.

(3) Demonstrate profitable low-input, reduced tillage production systems on a field-scale.

(4) Optimize relay intercropping technologies, including weed management.

(5) Evaluate crop rotation benefits with respect to pest management and control.

(6) Evaluate legume germ plasm for use as nitrogen-supplying cover crops.

Project Duration: Three years (June 1, 1988 - May 31, 1991)

Funding: $147,000 in 1988; $68,000 in 1989. Matching, $694,764.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$147,000	$559,764
Clemson University	68,000	135,000
Totals	$215,000	$694,764

LS88-8: DEVELOPMENT, IMPLEMENTATION AND EVALUATION OF LOW-INPUT CROP AND LIVESTOCK SYSTEMS FOR THE SOUTHERN REGION (88-96-2)

Final Report

Major Participants:

Virginia Polytechnic Institute and State University: John Luna (Project Coordinator), Dept. of Entomology, Blacksburg, VA 24061. Lee Daniels, David Parrish and Vivien Allen, Dept. of Agronomy; Joe Fontenot, Dept. of Animal Science; Gordon Groover and Dan Taylor, Dept. of Agricultural Economics; David Vaughan, Dept. of Agricultural Engineering; Nicholas Stone, Dept. of Entomology; Scott Hagood, Dept. of Plant Pathology, Physiology, and Weed Science.

Cooperators:

Extension: Mr. Harold Roller, Rockingham County; Joe Derting, Washington County

Virginia Polytechnic Institute and State University: Chuck Miller, Manager, Dairy Center; Dan Brann, Extension Agronomist; Erik Stomberg, Extension Plant Pathologist.

Farmer Participation:

Floyd Childress, Beef Producer, Christiansburg, VA; C.E. Allison, Dairyman, Glade Spring, VA; Dale Heatwole, Dairyman, Harrisonburg, VA; Kyle Bishop, Dairyman, Riner, VA.

Overview

This ongoing project, coordinated by John Luna of Virginia Polytechnic Institute and State University, consists of three parts: (1) a long-term whole-farm systems study involving crops and livestock, (2) on-farm grazing systems demonstrations, and (3) the development and implementation of a low-input corn production system.

Project Results

Part 1 is a farm-scale experiment designed to compare a conventional crop/livestock system with an experimental, low-input system to produce beef cattle. Involving 48 steers on 80 acres of crop and pasture land, this is the largest low-input farming system comparison study in the US. Conventional livestock production systems in the Southern region rely heavily on harvested forage (mostly alfalfa) and corn produced with heavy dependence on purchased inputs of fertilizers and pesticides. Findings of this study indicate that (1) spring and fall grazing of alfalfa have reduced the need for insecticides to control alfalfa weevil, (2) growing millet before alfalfa reduces the need for herbicides and insecticides, (3) first year corn following alfalfa does not require insecticides for corn rootworm or armyworm control and has reduced N

fertilizer needs, and (4) planting alfalfa into tall fescue reduces the need for N fertilizer.

Part 2 is an on-farm grazing systems demonstration project established on a cooperator farm in Southwestern Virginia. Two forage/beef systems are being compared. The first involves rotational and continuous grazing, the use of legumes vs. nitrogen fertilizer. The second involves sequencing of various forage species for year-round grazing. Each system uses 30 cows with their calves and continues the calves beyond weaning through the stocker phase. Four replications of pastures were established in the summer and fall of 1989, including various combinations of tall fescue, alfalfa, and red clover, with and without chemical inputs.

Part 3 involves the development and demonstration of low-input corn production practices, including the use of conservation tillage systems, winter legume cover crops and integrated pest management practices for weeds and insect pests. These on-farm demonstrations were conducted on 14 farms in 1991-1992. Corn production systems being compared include treatments such as use of a rye cover crop mulch, a mixture of hairy vetch and bigflower vetch cover crops, and various levels of N fertilizer application under alternative tillage systems. The no-till system earned a $44 greater net return per acre than that of the disk tillage system. Within the no-till system, the hairy vetch cover crop with no added N fertilizer earned about $22 more net returns per acre than did a rye cover crop with 125 lbs of N fertilizer per acre. These findings augment a growing body of published literature confirming the economic advantages of using winter legume cover crops in corn and other cropping systems.

An experiment involving low-input corn systems evaluated alternative management practices for rye cover crops in no-till corn. Comparisons were made between mowing and conventional herbicide to suppress the rye. Densities of armyworm larvae were estimated from the time of corn seedling emergence until armyworm larvae were no longer found. In four of the five fields in both years, mowing significantly reduced armyworm population densities in the early stages of corn growth. Mowing also adequately suppressed rye cover crop regrowth in all fields. Costs of the cover crop management methods are calculated to be about $6 per acre for mowing versus $10 per acre for paraquat spraying. Averaged across all plots in both years, fields where the cover crop was mowed earned $40/acre more net income than fields where paraquat was used to kill the rye cover crop.

Over the past few decades, "expert systems" computer software has made major contributions in industries like medicine and defense. An expert system is being designed for this project. A prototype computer-aided decision support system called CROPS (Crop Rotation Planning System) has been developed for farm-level planning. This program uses artificial intelligence techniques to generate crop rotation plans for individual farms, implementing low-input sustainable practices and comparing these plans with conventional alternatives. The final version will not only generate crop rotation plans that implement low-input practices; it will also analyze the plans generated and allow the farmer-user to compare the generated plans with an alternative. The system includes simulation models for estimating soil erosion and analysis of the financial status of the farm under various alternative combinations of crop mixes, farm program participation and machinery.

Objectives

(1) Develop and evaluate crop/livestock farming systems that minimize reliance on non-renewable inputs while maintaining or improving profitability, improving long-term soil productivity, and minimizing undesirable environmental impact.

(2) On four cooperating farms, evaluate and demonstrate the role of winter-annual legume/small grain polyculture cover crops in reducing nitrogen fertilizer, herbicide, and insecticide inputs in corn production.

(3) Evaluate the potential of ridge-till systems for corn production in the southeastern United States.

(4) Develop and implement Extension educational programs to promote the adoption of low-input farming technologies, practices, and systems.

Project Duration: June 1, 1988 - May 31, 1991

Funding: $90,000 in 1988; $120,000 in 1989; $180,000 in 1991. Matching, $447,071.

Organization	Sustainable Agri. Funds	Matching Funds
VPI	$390,000	$372,071
Tennessee Valley Authority	--	$10,000
Farmers Cooperating	--	$65,000
Totals	$390,000	$447,071

1991 Continuation

LS88-8.2: LOW-INPUT CROP AND LIVESTOCK SYSTEMS FOR THE SOUTHEASTERN UNITED STATES (Second continuation of project LS88-8; also known as **LS91-37(120)**.

Major Participants:

Virginia Polytechnic Institute and State University: Dr. John M. Luna (Project Coordinator), Dept. of Entomology, Blacksburg, VA 24061, Phone: (703) 231-4823. Nicholas D. Stone, Department of Entomology; Dr. John Roach, Department of Computer Science; Dr. Rosalind D. Buick, Department of Entomology; Dr. James W. Pease, Department of Agricultural Economics; Dr. Lee Daniels, Department of Crop & Soil Environmental Sciences.

Cooperators:

USDA: Dr. Bruce Julian, State Resource Conservationist, Soil Conservation Service, Richmond, VA; Neal Vines, Extension, Area Farm Management Agent and Computer Resource Specialist, Fauquier County, Warrenton, VA; Dr. Charles R. Meyer, Programmer/Analyst, USDA/ARS National Soil Erosion Research Laboratory, Purdue University, West Lafayette, IN; Dr. Dan Yoder, Programmer/Analyst, USDA/ARS National Soil Erosion Research Laboratory, Purdue University, West Lafayette, IN.

Farmer Participants:

Mr. Floyd Childress III, Crop/Livestock Operation, Christiansburg, VA; Mr. Sandy Fisher, Sabot Hill Farm, Manakin/Sabot, VA.

Overview

Widespread adoption of low-input, sustainable agricultural practices may be the only practical solution to the multifaceted crisis of American agriculture. Although low-input farming systems are increasingly recognized as economically viable and environmentally preferable to conventional, petrochemically based agriculture, the practical problems involved in whole-farm planning have largely not been addressed. Implementing low-input, biologically based farming systems may involve growing new crops, growing old crops in new rotations and with different tillage practices, and learning new techniques for improving soil tilth and ecological pest management. Because of the new management skills and knowledge required, the transition from conventional to low-input farming is generally perceived as an uncertain and risky venture. Furthermore, federal farm programs, and the interdependencies of farming operations often make impractical the adoption of component practices that may appear attractive in isolation.

The Research and Extension project proposed here involves the use of artificial intelligence and expert systems to continue the development of a computer-based planning tool to help farmers choose whole-farm crop rotations, tillage and pest management practices that help achieve a more sustainable agriculture. Expert systems are excellent tools to deal with complex problems which require the synthesis and application of a broad knowledge base. The proposed system is call CROPS (Crop Rotation Planning System) and is a unique tool for farm-level planning. It is the only system that develops coordinated, whole-farm plans for specific farms. CROPS develops crop rotation plans for each field in a farming operation and then tests and compares the expected economic and environmental performance of the generated plans with alternatives presented by the farmer or alternative plans generated by the system. These evaluations will be based on simulation models of whole farm profits and soil erosion.

The system is being developed in cooperation with two farmers operating diverse crop and livestock farms in the Coastal Plain and the Appalachian mountain areas. The farmers will provide design advice, will test the feasibility of the system on their farms, and will

cooperate with County Extension Agents and the Project Coordinators in designing the system, documentation, and training materials.

Objectives

CROPS is a computer program that selects crop rotations for each field on individual farms, ensuring that the combined crop rotations, i.e. the whole-farm plan, meets the production and financial needs of farmers, while also implementing low-input, sustainable practices. Development of the CROPS system was initiated in August of 1990 with funding from the Southern Region LISA program. That grant (LS90-29) supported the first year of a three-year project. This proposed research would continue the development of the CROPS farm-level planning system for a second year. Specific tasks to be undertaken in year two are described below in the methodology section. The following objectives are the entire project.

(1) Continue development of CROPS, a computer-based expert system to devise whole-farm crop rotation plans and integrate low-input farming practices.

(2) Incorporate the soil erosion prediction models identified by the Soil Conservation Service (SCS) as their standards (RUSLE and WEPP[2]) to analyze the effects of crop rotation plans developed in Objective 1 on soil erosion.

(3) Incorporate an economic model of a farming operation (FLIPSIM-V[3]) to evaluate the economic effects of potential farm plans developed.

(4) Evaluate the feasibility of whole-farm plans developed in Objective 1 on two Virginia crop/livestock operations.

Project Duration: Two years

Funding: $180,000 in 1991; $180,000 in 1992. Matching, $95,180, for funding year 1191 only. (Included in budget table for project LS88-8.)

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[2] RUSLE stands for Revised Universal Soil Loss Equation. It is a set of algorithms for more accurately estimating the parameters that are currently used in the USLE model. WEPP stands for Water Erosion Prediction Project and is a process-based simulation model of soil erosion and deposition across a topographical profile.

[3] FLIPSIM-V is the fifth revision of the Firm-Level Income tax and Policy Simulation Model (FLIPSIM).

LS88-9: A COMPARISON OF CROPPING SYSTEMS MANAGED CONVENTIONALLY OR WITH REDUCED CHEMICAL INPUT (88-32-3)

Final Report

Major Participants:

North Carolina State University: Larry King (Project Coordinator), Soil Science, Soil Science Department, Box 7619, Raleigh, NC 27695-7619. Keith Cassel, Soil Science; Maurice Cook, Soil Science; Udo Blum, Botany; Dana Hoag, Economics and Business; Donald P. Schmitt, Plant Pathology; Arthur G. Wollum, Soil Science; A. Douglas Warsham, Crop Science.

Overview

This project expands an ongoing experiment on reduced chemical input cropping systems. The long-term study was started in the Fall 1985 on a 6-hectare site in the Piedmont near Raleigh, NC. Continuous corn, continuous grain sorghum, corn-wheat-soybeans, and corn-wheat-soybean-corn-red clover cropping systems are managed conventionally (recommended rates of commercial fertilizer and pesticides) and with reduced chemical inputs (legumes for N, cultivation for weed control, no insecticide). The study is envisioned as an outdoor laboratory in which investigators from various disciplines monitor specific aspects of the experiment.

Project Results

The study was started in September 1985 on a Piedmont site near Raleigh. The core experiment consisted of four cropping systems: continuous corn, continuous grain sorghum, corn-wheat-soybean rotation (2-year), corn-wheat-soybean-corn-red clover rotation changed to corn-red clover-wheat-beans after the first cycle [4(3)-year]. Each cropping system was managed with CMP (no-till planting, recommended rates of fertilizer and pesticides) or RCI (conventional tillage, crimson clover or red clover as green manure crops, cultivation for weed control). Some of the core treatments were not very productive, so new RCI treatments were added to try to improve production: killing clover cover crops earlier to allow earlier corn planting, adding N fertilizer at planting, banding herbicides during cultivation, planting corn into mechanically killed or herbicide-kill strips in crimson clover, and adding N to wheat.

Crop Yields

Crimson and red clover cover crops varied in biomass production (1.7 to 3.5 tons/acre) and N accumulation (60 to 165 lb/acre) during the 7-year period.

In 1986-1988 and 1990 all corn yields were low (13-40 bu/acre) due to drought. In the other years, yields with CMP ranged from 60 to 130 bu/acre, and yields with RCI were up to 50% of CMP yields. Improved corn yield due to rotation was much more pronounced with CMP than with RCI.

Adding N to the RCI treatments at planting and banding herbicides at cultivation improved yields. For example, with continuous corn, RCI yields were comparable to CMP yields at the same N rate. Planting date had no consistent effect on yields. Yields of corn planted into killed strips of crimson clover (10 to 40 bu/acre) generally were not affected by kill method (mechanical or herbicide), but yields were lower than CMP yields. Low yields with RCI were due in part to competition from johnsongrass. Ear leaf N content was in the deficient range with RCI, suggesting insufficient N from the cover crops and/or competition from the johnsongrass.

Grain sorghum yields with CMP (15 to 40 bu/acre) were generally comparable to or greater than RCI yields. Effect of management on soybean yield (15 to 35 bu/acre) was mixed: 1986 and 1989, CMP=RCI; 1987 and 1992, CMP>RCI; and other years, CMP<RCI. Wheat yields (10 to 60 bu/acre) were higher with CMP because inadequate N was available to RCI wheat. Supplementing RCI with N improved yield some years.

Economic Analysis

The average return over operating cost over the 7-year period was a) negative for both CMP and RCI continuous corn (annual $30/acre loss), b) more profitable for CMP than RCI in the 2-year rotation ($80 vs. $35/acre), and c) equally profitable for CMP and RCI in the 4(3)-year rotation ($85/acre). Hay was the most profitable crop in the 4(3)-year rotation.

Equipment Development

Equipment was developed to attach ahead of the planter to mechanically kill a strip in crimson clover. Equipment also was developed to modify a commercial cultivator so it would not plug with the large amount of residue in these strip-killed treatments.

Nutrient Cycling

Since CMP included no-till planting, considerable C (3400-5800 lb/acre) and P (8-14 lb/acre) accumulated in the surface residue, and labile inorganic P accumulated in the 0- to 2-inch soil layer. Conversely, incorporation of crop residues and crimson clover led to increased total soil organic C and higher labile inorganic P with RCI and compared to CMP. Tillage, the presence of cover crops, and grain yields exerted the greatest influence on C and P cycling. 15 N studies showed that recovery of N (soil inorganic N + N in the corn plant) from crimson clover or fertilizer N was similar after one growing season (62%).

Soil Microbiology

A comparison of crimson clover vs. fertilizer N showed 260% more *Bacillus* spp., 310% more antinomycetes and 120% more total bacteria with crimson clover. In addition, microbial biomass C, available N, and activities of alkaline phosphatase, arylsulfatase and B-glucosidase were significantly higher with crimson clover.

Soil Moisture and Soil Impedance

Gravimetric moisture measurements and measurements with a time domain reflectometer and neutron meter generally did not show any effect of treatments on water use by corn. Most differences in soil infiltrability occurred in the trafficked interrow due to the effect of kinds and amounts of crop residue on the soil surface. However, the measured differences were not great enough to affect the soil water regime for the crop rotations studied, especially for the weather regimes encountered.

Generally, impedance (an estimate of resistance to root penetration) was greater in the interrow area than in the row, and was a direct result of wheel compaction. Higher impedance was found with RCI than CMP because of lower soil moisture content due to extraction of soil water by the crimson clover cover crops. In summary, after 7 years of cropping using various cropping systems, only small differences in water regime, infiltrability, and mechanical impedance were observed.

Entomology and Nematology

Soil and plant samples were taken in 1989 and 1990 to determine the effect of treatments on arthropods (predators, pests and detritivores). In continuous corn, populations of predators and detritivores were higher and populations of pests lower with RCI as compared to CMP. In the 2-year rotation, pests and predators were generally higher with CMP.

Lesion, stunt and spiral nematodes were the dominant nematodes found in the experimental site. Lesion populations were at least two-fold greater in CMP continuous corn and sorghum than in rotation treatments or treatments involving crimson clover. Spiral nematode was more abundant in rotations regardless of the management system. No trends were noted with stunt nematode.

Extension

Emphasis was placed on training sessions for extension agents, producers, soil and water district personnel, soil science professionals, etc. to explain the concept and practices involved in sustainable agriculture. A fact sheet on sustainable agriculture was produced.

A survey of the distribution of manure production in North Carolina was conducted. Maps were developed showing (by county) the quantity of nutrients available from manure. Manure could supply 100% of the crop needs for N in three counties, P in 19 counties and K in eight counties.

Objectives

(1) In an ongoing field experiment, maintain four cropping systems managed conventionally or managed with reduced rates of commercial fertilizer and pesticides (hereafter referred to as "low-input"). Monitor crop yield, cycling of N, P, and C in the soil-plant system; concentration of allelopathic

compounds (phenolic acids) in soil; shifts in composition and number of soil arthropods and nematodes; microbial population and activity; soil infiltration capacity and recharge of plant available water; and economic viability of each cropping system.

(2) For conservation tillage and natural reseeding systems, develop or adapt equipment to mechanically kill strips in winter green manure crop, no-till plant into kill strip, or allow green manure to mature seed and then cultivate through green manure residue to control weeds, leaving as much residue as possible on the soil surface.

(3) Develop response functions based on various inputs (legumes, reduced fertilizer rates, cultivation, soil properties, etc.) and apply them to actual North Carolina farms to determine the effect of low-input methods on crop yields.

(4) Determine the economic impact of various reduced low-input methods on farm profitability.

(5) Develop extension programs to increase awareness of Extension agents and specialists regarding the scope and purposes of low-input agricultural systems; provide Extension agents and specialists with current and applicable research information on low-input agriculture from other studies.

Project Duration: June 1990 - June 1992

Funding: $190,000 in 1988; $65,000 in 1989. Matching, $405,464.

Organization	Sustainable Agri. Funds	Matching Funds
North Carolina State University	$255,000	$405,470
Totals	$255,000	$405,470

LS88-10: SOLARIZATION AND LIVING MULCH TO OPTIMIZE LOW-INPUT PRODUCTION SYSTEMS FOR SMALL FRUITS (88-87-4)

Final Report

Major Participants:

Texas Agricultural Experimental Station: Charles R. Long (Project Coordinator), Texas A&M University, Agricultural Research and Education Center, Overton, Texas 75684; Kim Patten (Original Project Coordinator), Fruit Research, Texas A&M University, Agriculture Research and Extension Center, Overton, Texas 75684, Phone: (214) 834-6191. Ray Smith, Legume Breeder, Overton, Cover Crops; Vince Haby, Soil Fertility, Overton, Fertilization and Soil Interaction; Jim Starr, Plant Pathologist, College Station, Nematology; David Bender, Vegetable Research, Lubbock, Strawberry Solarization.

Texas Agricultural Extension: Calvin Lyons, Fruit Extension Specialist, College Station, Grower Education; Marty Baker, Horticultural Extension Specialist, Overton, Grower Education.

USDA/Agricultural Research Service: Barbara Smith, Small Fruit Plant Pathologist, USDA Small Fruit Research Station, Poplarville, MS, Strawberry Solarization.

University of Georgia: Gerard Krewer, Fruit Extension Specialist, Living Mulch.

Overview

Disease, insect and weed pressures can be major limiting factors to successful fruit production in the South. Production of most horticultural crops in the South is chemical and labor-intensive. Some fruit crops like blueberries and strawberries, however, may lend themselves to alternative farming systems. For blueberries, disease and insect pressures are minimal. The crop could be grown free of chemical inputs if suitable management alternatives to soil fertility and weed controls were available. One alternative is the use of living mulches. By proper selection of living mulch cover crops, weed competition could be eliminated through both a smothering of the weeds and an allelopathic effect. Nutrient inputs could also be supplied by the decomposing mulch.

Strawberry yield was not affected by soil solarization relative to the control or soil fumigated plots. Yields in all soil treatments were high with 29700 kg fresh berry/ha. Manured plots (44800 kg manure/ha) produced an additional 8000 kg fresh berry/ha compared to control plots. Use of green manure or chicken manure alone or in combination produced yields equivalent to the use of commercial N fertilization.

Progress Report

Solarization for Strawberry Production

With soil solarization, sustainable annual strawberry production in the South was obtained. If done correctly, solarization may be an adequate fumigation substitute for controlling soil-borne pests, such as weeds and nematodes. It is not, however, a fail-safe alternative to fumigation. Solarization will not be effective at sites that are plagued with extremely high populations of pathogenic nematodes or difficult to control perennial weeds, like nutsedge. Solarization plastic must be applied at the correct time of year to maximize solar heating. It is most effective during the hottest part of the summer with the longest day lengths. We have also encountered other problems with the use of solarization, such as obtaining the appropriate type of plastic. Under our solarization system, the plastic must last at least one year in the field. This allows for the plastic to be in the field 2 months for solarization, sprayed white and planted with strawberries and then replanted with a vegetable crop the following summer. Several of our initial attempts at solarization were not successful because the plastic lasted only 4 to 5 weeks. Obtaining clear plastic with sufficient UV protection to last a year is currently difficult on short notice.

To be completely sustainable, alternative inputs of nitrogen into the soil must be done prior to solarization. The use of either a combination of both winter and summer legume green manure, manuring followed by a nonlegume cover crop, or direct manure applications prior to solarization provided yields equivalent to use of commercial N fertilization at Overton. Adequate biomass must be produced by the cover crop or enough manure added to supply the nutrient requirements of the desired crop. Two successive, well established crops of legumes were able to satisfactorily meet the needs of the strawberry crop at Overton. In Lubbock and Poplarville cover crop use as a green manure was not as successful. Timing of planting after green manuring and inadequate cover crop production (single crop vs two crop rotation) contributed to the poor response at these locations.

The remaining limiting factor for a complete "organic" production system under a solarization/manure scenario would be the control of fruit rots. This last season, extremely heavy rains during harvest season (>16 inches) caused some cullage (10-15%) due to fruit rots. No sprays were used to control decay. We felt that this level of loss due to decay, although double the amount from the previous year, was acceptable. Decay levels were not significant enough to make fungicide applications an absolute necessity for the system.

Economics for using solarization appear comparable to that of fumigation without the environmental hazards, and significantly better than not treating the soil at all. The Economics of this system, could be improved by double cropping (following strawberries with cantaloupes on the same plastic). Cost for the low-input system will depend on which nutrient input option is used. Yields for each nutrient input options have not been evaluated yet. A solarization + manure system would cost $260 less per acre than fumigation + conventional fertilization, and only $75 more than the use of just black plastic alone. If conservative yield and price values are used and there is no differential in price received for fruit, our data for the last 2 years indicates that the conventional system is 25% more profitable than the low-input solarization system. At a 10% price differential between

"organic" and conventional fruit there is no difference in net return between the systems; at a 20% differential the solarization system has a 20% greater return. The solarization system was always more profitable than the system which had no soil treatment. In the short run, the use of solarization would only be monetarily expedient for growers who could capitalize on the organic market niche or who did not have access to fumigation equipment. As with most low-input sustainable systems, however, the major monetary benefits are hidden in the long term increases in land productivity.

Blueberry Living Mulches

When the efficacy of living mulch systems for blueberries was evaluated by Kim Patten and his colleagues in growers' fields in Texas and Georgia, rye and annual rye grass resulted in the highest mulch production and most consistent stands of mulch crops in the winter. In producing blueberries, it is absolutely essential to have a ground cover or a mulch, to protect the plants in the winter. This is a very expensive operation when farmers buy and distribute straw or some other kind of mulch in their blueberry fields.

Farmers in this project are growing their own mulch right in the fields. Pearl millet was the most successful cover in the summer. Crimson clover was the only legume tested that was found to be suitable for a living mulch crop. Several crops, especially pearl millet, exhibited allelopathic weed control. The estimated cost of using cover crops twice a year for living mulch is $130 per acre for blueberries, approximately the same cost encountered with the conventional blueberry fertilizer and herbicide program. However, the living mulch provides many advantages farmers don't get from chemicals -- advantages that are being tested over several years to protect growers against false "successes" that may fail after a year or two.

Objectives

(1) Investigate the feasibility of eliminating fertilizer and herbicide input on blueberries grown in the South through the use of a combination of legumes and annual summer forage crops as living mulch systems.

(2) Evaluate solarization as a replacement for fumigation and cover crop production as a replacement for synthetic chemical herbicides and fertilizers in growing strawberries.

Project Duration: Three years (June 1, 1988-May 31, 1992)

Funding: $40,000 in 1988; $40,000 in 1989. Matching, $81,197.

Organization	Sustainable Agri. Funds	Matching Funds
Texas Agricultural Experimental Station	$80,000	$81,197
Totals	$80,000	$81,197

LS88-11: DEVELOPING AND EXTENDING MINIMUM INPUT STRATEGIES FOR WEED CONTROL IN AGRONOMIC AND HORTICULTURAL CROPS

Final Report

Major Participants:

University of Arkansas Cooperative Extension Service: Ford L. Baldwin (Project Coordinator), Extension Weed Scientist, Section Leader -- Pest Management, P.O. Box 391, Little Rock, AR 72203. John W. Boyd, Extension Weed Scientist; T.L. Dillon; T.W. Dillon; K.L. Van Pelt.

Overview

The coordinator of this project is Ford Baldwin, Arkansas Cooperative Extension Service. A grower advisory panel, consisting of one soybean/cotton and wheat grower and one soybean/vegetable grower have helped with planning, conducting and evaluating the project. This project is a major component of Baldwin's ongoing research program consisting of about 50 studies annually.

Findings of this project show that reduced herbicide programs are both possible and practical with no loss in weed control and crop yield in many locations and crops in Arkansas. Major findings have shown that herbicide inputs can be greatly reduced by substituting mechanical weed control, spraying herbicide in narrow bands, targeting herbicides to most susceptible weed species, and making very early applications.

Project Results

The data base for minimum herbicide rates continues to be expanded. The reduction in inputs has progressed from labeled broadcast rates to labeled band rates to reduced broadcast rates to reduced band rates. The progression from reduced broadcast rates has been the primary objective of this LISA project.

For horticultural crops in 1991, we took the weed control methods that we had tested on a small plot basis in 1990 and applied them on a commercial scale. Our farmer-cooperator committed 10 acres which were planted cantaloupes. No herbicides were used for weed

control on these 10 acres. Non-chemical weed control measures were: (1) seeding crimson clover the previous fall for weed suppression between the rows and (2) using 36 inch wide, brown, photodegradable plastic mulch for weed control in the rows. This commercial scale project was a failure in terms of crop production due to heavy weed pressure and the inability to keep the crop watered. In spite of the band of plastic in the row, morning glories and spurge grew from the row middles onto the mulch creating excessive competition. The crimson clover provided some weed suppression but it was not sufficient for the weed population present in this field. Reduced effectiveness of the cover crop in 1991 was due in part to reduced stand density compared to 1990. We suspect the reason for this was that the seed was incorporated in 1990 and left on top of the soil in 1991. Rodent damage to the drip irrigation lines was so great that it was impossible to keep them patched which resulted in drought stressed plants. We suspect that the heavy cover of weeds and cover crop in the row middles attracted the rodent population.

We located a small plot, replicated study in the corner of the commercial field to evaluate methods not studied in 1990. These included using heavy brown wrapping paper as mulch to overcome the disposal problem associated with plastic mulch, adding cereal rye to crimson clover to gain an allelopathic effect, no-till seeding directly into the cover crop using either mowing or herbicides to kill the cover crop and adding conventional black plastic and IRT (infra-red transmitting) green plastic to be compared with the photodegradable brown plastic.

The direct seeded no-till plots did very poorly from the beginning of the season. It may be that transplants would improve the potential for success in a no-till situation. The other treatments worked well in the beginning but ultimately failed for the same reasons as the commercial scale trial. The paper mulch was difficult to apply with the mechanical mulch layer due to its brittleness. Once in place, it did well early in the season until the problems mentioned above caused the plant to succumb to drought stress and weed competition. The cereal rye did not enhance weed control.

Lessons learned from this year's studies were obvious: (1) some sites may have weed populations that make the plastic mulch/cover crop combination unworkable as the sole means of weed control. In these situations, wider plastic mulch would be beneficial. (2) Heavy weed and cover crop populations may encourage the presence of rodents that damage drip irrigation lines. (3) No-till, direct seeding of cantaloupes into cover crops will not work under some conditions. (4) Cover crop seed should be drilled or otherwise incorporated into the soil to ensure a thick stand. (5) Paper mulch seems better suited to small operations where it can be laid by hand.

The program of spraying 6-inch bands on 30-inch rows effectively integrates cultivation with chemical methods. In this program, weeds are controlled by cultivation on 4/5 of the area and by a combination of chemicals and cultivation on 1/5 of the area. Beginning in 1991, studies were initiated to incorporate cover crops in both flat-planted and ridge tillage continued into the reduced input programs.

During the course of the LISA funding, one reduced herbicide rate for the use of Whip herbicide in rice and one for the use of Harmony Extra in wheat has been incorporated into the University of Arkansas Weed Control recommendations.

Research by Carol Becton, Dr. Oliver's graduate student, is currently being published in M.S. thesis. Her research confirms that the Soybean Weed Control computer program accurately predicts both weed losses and reduced rate herbicide recommendations. In addition, her contour graph work should allow us to further refine the program.

Approximately 75% of the research and demonstration work supported by this project has been conducted on-farm with the remainder conducted on University Experiment Stations.

No formal materials have been prepared. However, Missouri has added reduced rates to the state weed control recommendations using Arkansas' as the pattern. North Carolina has added reduced rates to their computer program. In addition, we continue to receive a lot of requests to speak on the program in other states and several states have expressed an interest in adding reduced input recommendations.

A survey of county extension agents is conducted annually. Below are the three year averages from that survey.

Postemergence Herbicides - 1,845 growers used reduced rates on 749,000 acres at a savings of $6.90/A or a total of $5.3 million annually.

Soil-applied Herbicides - 1,645 growers used reduced rates on 706,000 acres at a savings of $5.25/A or a total of $4.2 million annually.

Objectives

(1) Develop a data base for the minimum herbicide rates required to control broadleaf and grass weeds causing the major economic losses in the major agronomic and horticultural crops in the South.

(2) Integrate the minimum herbicide rates with non-chemical methods of weed control.

(3) Develop minimum input weed control programs for multispecies weed situations in the major crops using combinations from (1) and (2) above.

(4) Develop written information and computer programs to facilitate the minimum input weed control technology adoption.

(5) Conduct extensive on-farm test demonstrations to facilitate adoption.

(6) Develop research guidelines and in-service training package for use in the states desiring to implement similar programs.

Project Duration: Three years (June 1, 1988 to May 31, 1992)

Funding: $50,000 in 1988; $40,000 in 1989; $100,000 in 1991. Matching, $110,000 in 1988; $112,250 in 1989; $109,571 in 1991.

Organization	Sustainable Agri. Funds	Matching Funds
University of Arkansas	$190,000	$331,821
Totals	$190,000	$331,821

1991 Continuation

LS88-11.2: DEVELOPING AND EXTENDING MINIMUM INPUT STRATEGIES FOR WEED CONTROL IN AGRONOMIC AND HORTICULTURAL CROPS (Second continuation of project LS88-11; also known as **LS91-38(53)**.)

Major Participants:

University of Arkansas: Ford L. Baldwin (Project Coordinator), Extension Weed Scientist, University of Arkansas Cooperative Extension Service, Little Rock, AR 72203, Phone: (501) 671-2221; John W. Boyd, Extension Weed Scientist.

Farmer Participants:

Grower-Advisors: Steele Craig; Boyce Johnson.

Overview

Weed Control in Agronomic and Horticultural Crops with Greatly Reduced Rates of Herbicide

Findings of this project show that reduced herbicide programs are both possible and practical with no loss in weed control and crop yield in many locations and crops in Arkansas. Major findings have shown that herbicide inputs can be greatly reduced by substituting mechanical weed control, spraying herbicide in narrow bands, targeting herbicide to most susceptible weed species, and making very early application.

For example, use of band application and new cultivator equipment have reduced herbicide costs in cotton from $21 to $2.30 per acre. Survey results indicate that approximately one-third of the Arkansas soybean producers have adopted this herbicide-reduction technology, at a cost savings of $7 million annually. Some of the concepts developed for soybeans are being adapted to other agronomic and horticultural crops in this

project, including vegetables. Research in wheat has shown that rates as low as one-fourth the labeled herbicide rates can be used.

Investigators have concluded that further reduction of herbicide inputs can best be accomplished by an integrated program of crop rotation, cover cropping, living mulches and tillage methods such as ridge till.

Project Duration: Two years

Funding: $100,000 in 1991. Matching, $109,571. (Included in budget table for project LS88-11.)

LS89-12: ENHANCING FARMER ADOPTION AND REFINING OF A LOW-INPUT INTERCROPPING SOYBEAN-WHEAT SYSTEM (89-55-1)

Major Participants:

Mississippi State University: Normie W. Buehring, (Project Coordinator), Senior Agronomist, Miss. Ag. & Forestry, North Mississippi Research and Extension Center, P.O. Box 456, Verona, MS 38879, Phone: (601) 566-2201. Serves as project coordinator, assimilates all farm input and crop yield data for appropriate economic analysis -- also assists in establishment and management of this system on farms and research plots. Alan Blaine, Area Agronomist, Cooperative Extension Service, establishes initial contact with interested farmers through local county agents and provides technical planting and harvesting assistance to farmer cooperators; Stan R. Spurlock, Department of Agricultural Economics, develops selected farm treatment cost and return budgets from treatment cost input and crop yield data supplied by project coordinator.

Cooperators: Mississippi

Innovative Mississippi farmers who were interested in the LISA project evaluating the wheat-soybean intercropping system (relay planting system) on their farm were contacted by the County Extension Agent and MCES Area Agronomist. The project coordinator (N.W. Buehring), Area Agronomist (M.A. Blain), and local County Agent usually met with the interested farmers to discuss their role in the project. The farmers who agreed to participate as cooperators in the LISA project provided the land, equipment and labor for land preparation, herbicide application and harvesting. The LISA project leader and Area Agronomist (currently Extension soybean specialist) provided technical assistance in all phases of production. The County Agents assisted in obtaining yield data and cultural practices data.

The local USDA/SCS (Summers) unit was involved in estimating soil loss for the different systems and locations. Mississippi State University's Agricultural Economics Department (Spurlock) is involved in doing the economic analysis for this project.

Cooperators: Arkansas

Two Arkansas farmers in cooperation with L.O. Ashlock (Arkansas Extension Service) agreed to participate in the LISA project in 1990 by establishing Extension demonstrations. These farmers provided the land and equipment to prepare the wheat seedbed, plant, harvest and apply pesticides on both wheat and soybeans. These demonstrations consisted of planting wheat in a prepared seedbed with solid row and skip row pattern (intercropping system) in the fall of 1989, followed by relay planting soybeans into the wheat in the spring of 1990. Farmer cooperators were Mr. Bill Weaver of Crittenden County and Mr. Ralph Greenwalt and Sons of Prairie County. In each county, the county Extension staffs cooperated very effectively with appropriate Extension specialist(s). Specifically, Mr. Steve Rodery, county Extension agent/agriculture of Crittenden County and Mr. Hank Chaney, county Extension agent/staff chairman of Prairie County have worked very closely with this project.

Overview

Research and Extension personnel at Mississippi State University have developed a low-input soybean-wheat intercropping system which involves mechanically planting soybeans between standing rows of wheat spaced 15-16 inches apart at the time the wheat grain is in the medium-soft dough stage. The year 1988 was the sixth year of research and development work on this system for planting soybeans into wheat using an established tractor wheel track skip (30-inch skips 2/20 ft. planter swath). The system reduces soil erosion potential, tillage and herbicide input costs, increases soybean yield and results in higher net returns than conventional monocrop soybeans and other soybean-wheat double-cropping systems. The system has practical application to small and medium-sized farms through improved net returns on the same land area without increasing acreage farmed.

This project involves the USDA/Agricultural Research Service, Soil Conservation Service, farmers, Extension and Research personnel in Mississippi, and farmers and Extension personnel in Arkansas. The purpose is to enhance the adoption of this low-input intercropping system and participate in further refinement of this system for small to medium-sized farms in these two states. The project (1989-92) involves seven Mississippi farms, three Arkansas farms, and two experiment stations. The highly variable weather conditions and low commodity prices during this study resulted in the cancellation of some of the farm studies during the life of this project. Most of the on-farm study results indicated that perennial winter weed (e.g. horseweed) control failures in the wheat carried over into the subsequent relay planted (RP) soybean crop and were not controlled with currently available postemergence soybean herbicides. In addition, soybean weed (e.g. spotted spurge and ragweed) control failures were also noted where postemergence herbicides were not applied immediately following winter wheat harvest. The lack of good weed control had a significant effect on causing lower soybean yield. This is in sharp contrast to soybeans planted in wheat stubble in late June which received a burndown herbicide that provided excellent weed control.

Economic analysis of selected farm studies indicated that three of six farm-yrs. (farm x yrs), the RP system produced higher net return than planted in wheat stubble in late June. Five of seven farm-yrs, the monocrop soybeans produced higher net return than either

doublecropping system. The higher net return for monocrop beans was partially due to ineffective weed control which caused lower yield in the RP system. The decline in burndown herbicide costs (as much as 50%) in recent years, also, lowered the direct cost for the wheat stubble system.

One year (1990) of evaluating wheat row spacings postemergence herbicides, and cultivation combinations for weed control indicated that a high clearance no-till cultivator was not able to maneuver through the wheat stubble in the narrower (30-inch) soybean rows. Most high clearance cultivators work best with wider row spacings (36-40 inches).

The raised wide-bed RP system, on poorly drained soils, increased wheat yield two of three years for a three year average of 13% more than planted flat; but had no effect on soybean yield. SCS soil erosion estimates indicated that both wheat-soybean doublecropping systems (relay planting and planting in wheat stubble) reduced soil erosion about 25-40% compared to monocrop conventional tilled soybeans. The first year (1992) evaluation of 26 soybean cultivars relay planted into wheat indicated that most cultivars were more sensitive to this intercropping culture than planted as a monoculture on the same date. However, some cultivars showed less sensitive to the intercropping culture than other cultivars.

Objectives

(1) Enhance small and medium-sized farm adoption of a low-input reduced-tillage intercropping system for relay interplanting of soybeans in wheat.

(2) Refine this system by evaluating narrow wheat row spacings alone and in combination with reduced herbicide inputs and cultivation for enhanced wheat yield and weed control.

(3) Demonstrate lower input costs and enhanced profitability for low-input soybean-wheat intercropping system.

(4) Evaluate this system on soils with poor surface drainage using a wide-bed system.

Project Duration: Twenty-eight months starting March 1, 1989

Funding: $120,000 in 1988. Matching, $244,883.

Organization	Sustainable Agri. Funds	Matching Funds
Mississippi State University	$86,250	$211,133
University of Arkansas	33,750	33,750
Totals	$120,000	$244,883

LS89-13: SUBSTITUTION OF CULTURAL PRACTICES FOR HERBICIDES TO CONTROL ANNUAL RYE GRASS AND CHEAT IN SMALL GRAINS
(Continued as LS90-28)

Final Report

Major Participants:

Oklahoma State University: John B. Solie, Agricultural Engineering Department, 112 Ag Hall, Stillwater, OK 74708, responsible for implementing Objectives 1, 2, and 3. H. Willard Downs, Agricultural Engineering Department, 216 Ag Hall, responsible for implementing Objectives 1 and 3; Thomas F. Peeper, Agronomy Department, 278 Ag Hall, responsible for implementing Objectives 1, 2 and 3; Francis M. Epplin, Agricultural Economics Department, 416 Ag Hall, responsible for implementing Objective 4.

Farmer Participation:

Robert Harschman, Stillwater, Payne County, OK; Don Kirby, Lamont, Grant County, OK; Earl Marshal, Hennessey, Kingfisher County, OK; Ray Nelson, Carrier, Garfield County, OK; Joseph Peeper, Enid, Garfield County, OK; Don Schieber, Kildare, Kay County, OK; Al Westfal, Lahoma, Garfield County, OK.

Overview

Winter wheat is grown continuously on a large portion of the acreage dedicated to crop production in the entire Southern Region of the United States. Attempts to introduce conservation tillage practices have always led to rapidly increasing infestations of weedy *Bromus*, *Lolium* and *Hordeum* species. Farmers are increasingly abandoning conservation tillage practices or are turning to herbicides to control these weeds. The introduction of new cultural practices including the modification of existing harvesting and planting equipment is a viable alternative to herbicides for controlling light seeded weedy grasses in small grains.

The proposed research and extension project developed and demonstrated quickly adoptable cultural methods with substantial potential for preventing pandemic infestations of cheat and annual rye grass, two of the most common grassy weeds found in the Southern Region. Practices include: 1) preventing the return of annual rye grass and cheat seeds to fields during harvesting, 2) increasing the natural ability of wheat to compete against annual rye grass and cheat by using new seeding techniques, 3) identifying wheat cultivars with greater natural abilities to compete against weedy grasses. A complete economic analysis was performed to evaluate the economic feasibility of the proposed practices.

Results of five years of research clearly show there are significant agronomic and economic advantages to seeding wheat in ultranarrow rows. In the presence of cheat and in clean tilled fields decreasing row spacing to 3 inches consistently increased grain yield an

average of 3 bushels per acre. Weed seed yield was frequently significantly reduced. Increasing wheat seeding had an additive effect on grain yield and weed seed suppression. Wheat cultivars were identified with potential to compete against cheat when seeded in 3 inch spaced rows. When herbicides were required, adoption of these practices will often enable the reduction of herbicide application. Grain drill modifications were developed to enable farmers to plant at this spacing in heavy crop residues. Estimated cost of this conversion was less than $1,000 per 10 foot grain drill. Economic analyses showed clearly the advantage to adopting these practices. Adoption of these practices could increase net returns $60,000,000/yr in Oklahoma while significantly reducing farmers' dependence on herbicides.

Project Results

Objective 1

Preliminary tests were conducted in 1989 to evaluate the potential of collecting chaff and straw from a harvesting wheat. Results were positive, but the volume of straw collected was so great that we decided to separate the weed seed from the straw.

During the spring of 1990, we designed and constructed a pneumatic collector and conveying system and mounted it on a Gleaner M-2 combine. This device collected weed seed, chaff, and shriveled wheat discharged over the combine shoe and conveyed the material to a trailing wagon, a separator in the wagon to remove the chaff. The modified silage wagon could hold all material collected while harvesting two combine bins of clean grain.

We established experiments in seven farmers' fields containing moderate to severe infestations of annual ryegrass or cheat. The weed seed collector worked as designed. The collector removed up to 410 lbs/ac of annual ryegrass seed and 180 lbs/ac of cheat. At two locations, we used the ultranarrow row grain drill to plant wheat. Seeding rates were 75 and 120 lbs/ac, and row spacings were 3, 6, and 9 inches. There were no significant problems with the weed seed collector.

Field tests, that summer, showed the collector-separator worked and would be practical with some modifications. However, the Southern Region Low Input Sustainable Agriculture Research and Education Program failed to fund the final year of the project, and the principal investigator for this objective took a position at another institution. Consequently, we elected to concentrate our efforts on the other objectives. Work was halted on this objective.

Objective 2

In addition to the LISA grants, the principal investigators were able to secure major funding from several sources to expand and continue research outlined in Objective 2. Research on the objective was initiated in 1988 with a one time grant from the Oklahoma Wheat Research Foundation. Subsequent research was funded in part by the Oklahoma Center for the Advancement of Science and Technology, Oklahoma Wheat Commission and the Southern Region Pesticide Impact Assessment Program. Results are summarized by year, below:

In 1988, averaged over area research locations, ultranarrow row seeding practices increased yields of cheat infested wheat by over 11% and decreased cheat seed production by up to 25%. Results of these experiments were used to plan field experiments under the LISA project initiated in the fall of 1989. Experiments were established at three locations to more completely define the interactions among wheat row spacing, seeding rate, and date of planting on cheat suppression and wheat yield. Experiments were also established at two locations to investigate the influence of the severity of cheat infestation on the benefits derived from manipulating row spacing and wheat seeding rate. Additional experiments were established on farmer participant fields to investigate and demonstrate the benefit of 3 inch row spacing and higher seeding rates on annual ryegrass and cheat suppression and wheat grain yield. It was apparent, based on 1988 research, that water injection was not a practical method for stimulating germination. Subsequent attempts to prime wheat seed failed to improve stands.

In the fall of 1989, five major experiments were established to determine the effects of row spacing, wheat seeding rate, weed seed density, and date of planting on wheat grain yield and weed seed yield. Results of these experiments, harvested in June 1990, showed that narrowing row spacing significantly increased grain yield and could reduce by half the dockage attributable to weed seed. Grain yield increases were as great as 455 lbs/ac in weed free treatments and 410 lbs/ac in weed infested treatments when row spacing was reduced from 9 to 3 inches. Increasing wheat seeding rate in weed infested fields will generally reduce weed seed and significantly increase grain yield. These benefits occur independent of the weed seed (cheat) density at planting. Grain yield increased as date of planting is delayed.

Experiments were conducted at three locations in 1990-91 to investigate the interaction of row spacing, seeding rate, and herbicide treatment on cheat control. Treatments consisted of the herbicides metribuzin and Finesse (a chlorsulfuron and metsulfuron premix) applied at two rates plus an untreated check; three row spacings 3, 6, and 9 inches; two seeding rates and cheat and weed free plots. At one location the combination of metribuzin and reduced row spacing increased wheat yield. At the second location decreasing row spacing increased wheat yield for all herbicide treatments and the check. The Finesse treatments increased wheat yield. At the third location, all herbicide treatments increased yield. Seeding at the higher rate increased yield. At one location the three way interaction of low rate of Finesse, reduced row spacing and increased seeding rate reduced cheat seed yield. At two locations, the combination of increased seeding rate and reduced herbicide rate decreased cheat seed yield. The experiments showed that the combination of planting in narrow spaced rows, increasing wheat seeding rates, and applying reduced rates on herbicides can increase wheat yields and reduce the amount of weed seed harvested.

During the 1991-92 crop year experiments were established to determine the effects of row spacing, seeding rate and herbicide treatment on annual ryegrass control. Treatments consisted of the herbicides; three row spacings 3, 6, and 9 inches, two seeding rates. Herbicides were required to improve wheat yields. However, reducing row spacing and increasing seeding rate enabled reduction of the herbicide application rate at one location.

Experiments were begun to investigate the effects of wheat cultivars, and row spacing on wheat vegetative growth (for cattle grazing) and grain yield in cheat free and cheat infested fields. The combination of dry weather followed by hail storms produced atypical results.

In the fall of 1992, the second year of the two year experiment to determine if the effect of wheat cultivar, row spacing, and weed infestation was begun. Experiments were initiated at three locations to determine the effect of row spacing on suppression of broadleaf weed, primarily wild buckwheat. Results of these tests will be reported in late 1993.

Objective 3

In addition to the LISA grants, the principal investigators were able to secure major funding from the sources listed in Objective 2 for Objective 3. In addition, they received contributions of equipment and components from Great Plains Manufacturing Company and John Deere Company to expand and continue research outlined in Objective 3. Results are summarized below:

During the first two years of the project, we used ultranarrow row plot drills built at the Agricultural Engineering shop to plant experiments. Only one U.S. Manufacturer built a grain drill capable of seeding cereal grains at ultranarrow row spacings. This grain drill was complicated, expensive and was not accepted by farmers. Consequently, we embarked on a program to design grain drill openers that were acceptable to farmers.

During 1990, we designed and tested two grain drill openers capable of placing seed in three inch rows while operating successfully in a wide range of tillage conditions. The opener designs were based on distinctly different concepts. Twenty-four units of each design were constructed and mounted on grain drills designed for the specific opener. These grain drills were extensively field tested on six farmer cooperator fields in the fall of 1990.

One of the designs met the initial design criteria: it could be operated in a wide range of tillage systems, it is simple, and it should be less expensive than conventional grain drill openers. This design used a floating knife opener and spring loaded press wheel to place seed in newly tilled soil. Precision of seed placement depth is similar to current designs. The opener could handle large amounts of crop residue. The grain drill, constructed in 1990, used an air seeder metering unit.

This grain drill was tested at 7 locations including four farmer cooperators' fields. The grain drill successfully planted a wide range of conditions including crop residue. The grain drill plots produced higher grain yields than those planted by a conventional row spacing double disc grain drill at a majority of the locations.

Analysis of previous years' data showed that grain yields were near optimum when planted in 3 inch spaced rows. Planting in 3 inch spaced rows frequently reduced weed seed yield. Yield data from 1990-91 experiments supported these findings. The new ultranarrow row (3 inch) grain drill opener will enable farmers to take advantage of these results.

Major equipment manufacturers, although interested in our research, were unwilling to build ultranarrow row grain drills. They did not believe ultranarrow row planting was compatible with the Conservation Compliance Program. Specifically, they did not think a 3 inch row spacing grain drill could plant in high levels of crop residue. In the fall of 1992 we modified a 7 inch spacing John Deere 9450 press wheel hoe drill to plant in 3, 4, 3, 4...inch row spacing. This grain drill proved capable of planting wheat in high levels of residue and could be operated at high speed. Experiments were established at 8 locations to compare performance of the grain drill with a conventional grain drill and the ultranarrow grain drill described previously. These experiments will be harvested in June 1993.

Objective 4

During 1989-1991 we collected data for economic analysis of the proposed cultural practices, including cooperating farmer surveys. We made economic assessments based on the data collected and developed mathematical models to assist in these analyses.

An analysis of the potential economic returns for planting in ultranarrow rows was conducted. Enterprise budgets were computed for farm sizes of 300 to 1000 acres using the representative farm approach. Use of an ultranarrow row grain drill will increase returns $6.79/ac for the 1000 acre farm, and the grain drill will increase returns $6.03/ac for the 300 acre farm. All data are being presented in a format compatible with the Planetor/Budgetor budget generator. Further analyses are being completed at this time.

Results of five years of research clearly show there are significant agronomic and economic advantages to seeding wheat in ultranarrow rows. In the presence of cheat and in clean tilled fields decreasing row spacing to 3 inches consistently increased grain yield an average of 3 bushels per acre. Weed seed yield was frequently significantly reduced. Increasing wheat seeding had an additive effect on grain yield and weed seed suppression. When herbicides were required, adoption of these practices will often enable the reduction of herbicide application. Grain drill modifications were developed to enable farmers to plant at this spacing in heavy crop residues. Estimated cost of this conversion was less than $1,000 per 10 foot grain drill. Economic analyses showed clearly the advantage to adopting these practices.

Objectives

1. Develop and demonstrate equipment to collect seed of weedy annual grasses discharged from grain combines to prevent their return to the field, and analyze the collected material to determine its potential feed value.

2. Compare winter wheat cultivars, seeding densities, plant spacing, and water injection at planting to identify the combinations that optimize the crop's competitiveness.

3. Design and construct a grain drill opener and metering unit, compatible with existing drills, that improves wheat competitiveness by: equally spacing wheat

seed in ultranarrow rows, and injecting small quantities of water to stimulate emergence.

4. Construct a mathematical programming model representing a family farm firm which accounts for the externalities associated with the use of herbicides and evaluate the economic environment consequences of production systems using alternative weed control strategies and relative to conventional herbicides.

Resource Development

Farmers (8) have been included in the planning, research, and on-farm demonstration phases of the project. Information has been primarily disseminated through popular press articles (15), refereed journal articles (15) and educational television farm news programs. This information has had a major impact on equipment buying patterns of Oklahoma farmers buying the narrowest row spacing grain drills.

Project Duration: One year (March 1, 1990 - February 28, 1991)

Funding: $80,000 in 1989; $60,000 in 1990. Matching, $82,640.

Organization	Sustainable Agri. Funds	Matching Funds
Oklahoma State University	$140,000	$67,876
Totals	$140,000	$67,876

LS89-14: ON-FARM DEMONSTRATIONS AND RESEARCH OF LOW-INPUT SUSTAINABLE FARMING

Final Reports

Major Participants:

Carolina Farm Stewardship Association, On-Farm Demonstrations and Research: Marjorie Bender, Carolina Farm Stewardship Association, 115 West Main Street, Carrboro, NC 27510, William W. Dow (Project Coordinator), Route 3, Box 333, Pittsboro, NC 27312.

Farmer Participants:

Bert Moss, Lenior County, Fruit and Vegetable Grower, raises 7 acres of peaches, 5 acres of strawberries, 2 acres of blueberries, 15 acres of juice grapes, 3 acres of melons and varying acreage of vegetables. A majority of his marketing is pick-your-own and roadside stand. He wants to reduce or eliminate the use of methyl bromide as a

fumigant on annual strawberry production and possibly organic strawberry production. In addition, his goal is to reduce total production costs and increase overall profitability.

Leonard Wood, Johnston County, Vegetable Producer, raises 10 acres of various vegetables. He also operates a U-Pick and roadside stand. He would like to try experimenting with legumes as a source of Nitrogen and as a weed suppressor in irrigated sweet corn. Dutch white clover (*Trifolium repens L.*) has been tried elsewhere. Undersowing and intercropping will be compared.

Jim and Bill Wallace, Wake County, Intensive Grazing Livestock Operators, are developing a registered Angus cow/calf operation using Voisin methods. At present they have 40 cows and sell at feeder and stocker auctions. One goal is to clean up and plant cut-over areas. Establishing warm season forages was discussed. Three long-term goals are to expand the carrying capacity and herd to 50 cows, improve genetic base, and develop a better market for cull calves. The possibility of contracting with an H & A producer was discussed. They will establish native switchgrass (Alamo, Kanlow or Cave-in-Rock cultivars) at 10lb/A and *Sericea lespedesas* (AU Lotan or AU Donnelly cultivars) at 30lb/A. A comparison will monitor cost and method of establishment, forage quality, and grazing time/day. Rainfall will also be recorded.

Murray Cohen, Chatham County, Organic Grain and Livestock Operator, recently purchased 100 acres that has been chemically farmed for over 50 years. He will use his management techniques to convert this land into organic production. Soil samples will be taken to monitor the biological and chemical changes. Yield, production and economic data will also be collected.

Ken Dawson, Orange County, Organic Vegetable Producer, recently purchased land and plans to put 9.5 acres into a legume cover and develop only .5 acre for vegetable production next year. Soil samples will be taken and yield, production, and economic data will also be collected.

Steve White, Buncombe County, Transitional Organic Vegetable Grower, is experimenting with red clover and Quailhaven soybeans in green peppers. He will look at intercropping green manures with vegetable crops.

Chris Holder, Randolph County, Grain and Livestock Producer, experimented with reducing post-emergence herbicide (poast) on no-till soybeans in 1990 and plans to design a no-till cultivar to reduce his use of post-emergence herbicides in both corn and soybeans.

Overview

Most farmers in North Carolina (NC) are interested in decreasing their dependence on chemical inputs, but do not know what alternatives are available to replace synthetic fertilizers and pesticides without reducing farm profitability. They need to see how these alternatives work on actual farms with constraints similar to their own before they are willing to risk their time and resources to make changes from conventional to lower-input practices.

The project encouraged growers with small to medium-sized farms to substitute more sustainable, lower-input practices for heavy use of synthetic chemicals. Project staff and consultants worked with demonstration farmers to plan appropriate reduced-input transition sequences for their farms, establish on-farm demonstrations and applied outreach programs to help other farmers adopt low-input practices. Networks of farmers, researchers, agricultural educators, and technical and marketing consultants supported demonstrations and outreach programs. This project was built on groundwork already established with a 1988-89 Planning Grant from the USDA Low-Input Sustainable Agriculture Research and Education Program, and the Carolina Farm Stewardship Association (CFSA)'s working relationship with other agricultural organizations and institutions. It was integrated with ongoing NC projects in sustainable agriculture to maximize its educational impact.

Project Results

In 1992, this project worked with six farmer participants to establish or revise five on-farm demonstrations. On one farm we began the initial planning, but additional planning needed to be completed before we could proceed. This will become part of our on-going on-farm demonstration program. Over the three year period thirteen on-farm demonstrations were undertaken.

The Green Book listing local markets continues to be promoted. An additional 120 books were distributed this year. In cooperation with the "Ways to Grow Program" at NC Agricultural and Technical State University (NCA&TSU), the Green Book is being revised and expanded to include South Carolina, border markets with Tennessee and Virginia, and other alternative markets. The Mountain Organic Growers Marketing Cooperative, located in Asheville, NC, has become another marketing avenue the project has indirectly worked to develop. Additionally, we have worked to help growers strengthen their market through collaboration rather than competition, linking southeastern NC growers with the mountain growers. We have sponsored the Marketing Conference as a member of the Southern Sustainable Ag Working Group, to be held in Raleigh, January 7-10, 1993.

To establish and revise on-farm demonstrations, technical committees were assembled to provide valuable expertise and participate in problem-solving/brain-storming sessions. These interdisciplinary teams were an exciting component of the entire project. They helped us avoid unnecessary duplication, strengthened the project design, fostered communication between technicians, specialists, and practitioners, and gave farmer-demonstrators easy access to information from specialists. Field days brought members of the technical committee together again to provide supporting information to the farmer's presentation of their demonstration, giving many more farmers access to technical expertise.

Outreach has been on-going. In 1992 four field days/farm tours were held, attracting over 150 people through mailed notices, and news releases to print and electronic media. One tour was coordinated with NCA&TSU which helped to pave the way to our partnership on the revised Green Book. The 7th Annual Sustainable Ag Conference attracted 160 participants. Three LISA demonstrators presented their results, one major participant from the Extension Research Center and the project director presented material on various aspects of the project. Participation in CFSA Board, Certification, Conference Planning and Regional group meetings provided more opportunity to share specific information on related activities.

Five conferences have been attended at which material was distributed or information dissemination was facilitated through networking. Participation in various sustainable ag committees, (including the NC Sustainable Ag Working Group, the Southern Organic Farmer Associations Council, the Chatham County Cooperative Extension Advisory Committee), has given the project opportunities to share activities and findings. Presentations were given both formally and informally throughout the year. Information continues to be exchanged with other LISA/SARE recipients (Dr. Mary Peet and Dr. Larry King). Articles in the Stewardship News have provided another avenue for outreach. Finally, we joined a computer network to help reach more people. There are many ways to share information. We chose those we felt would most effectively reach the people we most wanted to reach ----the farmers.

Objectives

(1) On-farm demonstrations and applied experiments of sustainable low-input farming practices will be established.

(2) Farm-specific transition sequences from conventional to sustainable low-input farming will be documented.

(3) Marketing resources needed by farmer participants for crops raised with less or no synthetic pesticides or fertilizer will be developed.

(4) Interaction between farm participants and technical advisors who can help growers draft farm plans and solve specific farming or marketing problems will be coordinated.

(5) Outreach programs to publicize demonstration farms and disseminate information about possible transition methods will be administered.

Project Duration: 35 months starting March 1, 1989

Funding: $100,000 in 1989. Matching, $100,000.

Organization	Sustainable Agri. Funds	Matching Funds
Carolina Farm Stewardship Association	$100,000	$100,000
Totals	$100,000	$100,000

LS89-15: ENHANCEMENT OF THE STABILITY OF SOUTHERN REGION AGRO-ECOSYSTEMS THROUGH PROFITABLE TRANSITION TO SUSTAINABLE AGRICULTURE

(Revised 2/4/91)

Major Participants:

Texas Department of Agriculture: Keith Jones (Project Coordinator), Sustainable Agriculture, Texas Department of Agriculture, P. O. Box 12847, Austin, TX 78711, Phone: (512) 463-1033.

Winrock International: F.E. Busby, Director, U.S. Programs, Morrilton, AR. Reduction in input approach to vegetable production: infrastructure for low-input sustainable agriculture/financing.

University of Arkansas: Gail Lee, Extension Horticulturist-Vegetables, Arkansas Cooperative Extension Service, Little Rock, AR. Reduction in input approach to vegetable production: diversified vegetable systems.

Oklahoma State University: Bob Cartwright, Assistant Professor, Wes Watkins Agricultural Research and Education Center, Lane, OK. Reduction of input approach to vegetable production of crucifer and sweet corn systems.

Kerr Center for Sustainable Agriculture: Teresa Maurer, Associate Director, Research, Poteau, OK. Reduction of input approach to vegetable production: farmer directed on-farm research.

Texas A & M University: Alton N. Sparks, Jr., Extension Entomologist, Texas Cooperative Extension Service, Weslaco, TX. Reduction input approach to vegetable production: onion systems.

Farmer Participants:

Practitioners, who provided cropland, equipment, supplies and labor. (Those in Oklahoma were also involved in scouting their crops and maintaining records for the project, as well as planning and developing the project.)

Arkansas: Stuart Fulbright, Northwest AR; Jay Fulbright, Southwest AR; Gordon Watkins, Parthenon, AR.

Oklahoma: Linn Shanks, Bixby, OK; Bill Sears, Talihina, OK; Bob Constein, Perkins, OK; Betty Carter and Charles Puckette, Poteau, OK; L.D. Roller, Wister, OK.

Texas: Julio and Ricardo Castilleja, San Juan, TX; Jimmy Carlson, LaVilla, TX; Andy Scott, Edinburgh, TX.

Overview

Cooperators from Arkansas, Oklahoma and Texas including farmers, researchers, and marketing, financial and extension specialists are working on a transitional approach to low-input sustainable agriculture focused on IPM in onions, sweet corn, crucifers and other vegetables in whole farming systems. Informational searches are being undertaken by the Texas Department of Agriculture in collaboration with farmers, Winrock International Institute for Agricultural Development, Kerr Center for Sustainable Agriculture, and Land Grant Universities in respective states. Research cooperators, including farmers, have been investigating various IPM tactics on small plots and will choose the most promising methods for larger on-farm demonstrations. Critical analyses by farmers help to ensure that the methods selected to lower inputs, sustain soil and other resources and maintain product quality, will also be practical for on-farm application. Inputs have been closely monitored and managed. TDA's marketing staff and Oklahoma State University have been investigating innovative mechanisms of financing LISA farming systems. And information developed in this project is being distributed to producers and consumers.

Milestones for this project have been:

- Initiation of some innovative demonstration research involving cover crops, economic thresholds for pests and weeds, alternatives to hard conventional pesticides, and slow release fertilizers.

- Development of on-farm demonstrations of scouting schemes and appropriate pest controls, with producers being involved as peer participants in all stages including planning.

- Documentation of action others are taking to establish alternative agricultural financing organizations and programs. (This will serve as a catalog of ideas and help identify principles upon which other organizations can build.)

- Undertaking of several farm community focus groups to better understand existing financing infrastructure and needs.

- Some insightful results from consumer and retail buyer-surveys into consumer attitudes.

In addition, some results from demonstration research have been reported and/or published. Also, cooperators have had several field days and farm tours. And a video, which will provide an overview and results of this project, is currently being prepared.

On the whole, this has been a project with extremely positive results. There have been spin-off benefits which include stimulation of non-vegetable grower interest in LISA, increased communication with other private and public entities which should be involved in LISA, increased networking above and beyond the scope of this project, increased knowledge about farming systems research and extension for some of the individual and organization cooperators, and a probable project in conservation and sustainable community development.

Objectives

(1) Identify and evaluate current information relevant to profitable transition to LISA vegetable production in the southern region.

This information is being generated by the various cooperators as they complete their work on objectives 2-4 and will be reported more comprehensively in the final report projected for late 1991. Some of this information is an inherent part of the work plan for the specific objective, and has been presented in previous reports or is presented herein [e.g., the research into financing options for sustainable agriculture by Busby and Bejarano (Winrock) and Muller and Perez (TDA)]. Also, the literature reviews in the progress reports being generated are providing this information. For instance Roberts and Cartwright (1990) published an experiment station report P-911, "A Reduced Input Approach to Cabbage Production: Managing Erosion, Fertility, and Pests" which provided a brief review of the role of cover crops and mulches in sustainable vegetable production systems.

(2) Develop on-farm tests to determine the agroecological effects of various pest and fertility management approaches in LISA production systems for onions, sweet corn and cabbage.

In Oklahoma, soil covers of hairy vetch and rye resulted in less pest pressure. Also there was a positive correlation of problematic pest densities and increasing amounts of applied synthetic nitrogen. Fewer insecticide applications were needed using a threshold base control program.

During the 1990 growing season, numerous on-farm experiments and demonstrations of low-input horticulture were conducted at seven locations in Oklahoma. Participating farmer-cooperators were identified early in 1989 and apprised of the progress of related research and development during that year in advance of any work done on-farm. These cooperators had expressed enthusiasm, and interest in such involvement as early as 1988 when public meetings to highlight sustainable agriculture were held in the region.

All cooperators had some experience in the growing of vegetable crops, though that experience ranged from non-commercial gardening to large-scale commercial production for the wholesale market. Of the seven cooperators, only one was not already involved in vegetable production for commercial marketing. Another, Eastern Oklahoma State College,

was also an experimental substation and teaching unit. The crops focused on in this work were cabbage, sweet corn and onions.

Three trials were conducted in cabbage fields combining both detailed scouting, use of an economic threshold and a biological "agent", *Bacillus thuringiensis* as the only insecticide. This was contrasted to plots sprayed on a calendar routine, but with the same biorationale. In the first of these trials, scouted plots required the same number of applications as the calendar-plots. The second and third trials however resulted in savings of one spraying at one location and seven sprayings at a second. Evaluations of pest damage and percent marketable heads did not suggest any consistent differences between treatments.

Another trial contrasted the use of *Bacillus thuringiensis* in conjunction with the synthetic insecticide methomyl and without it. Scouting was employed; however, the grower used his own threshold to determine the schedule of applications. No clear differences in marketable heads or insect damage could be detected. A fifth trial, underway at the time of this writing, employs the use of scouting and economic thresholds on both cabbage and cauliflower.

One of the greatest challenges to the grower in this project was the adjustment of the novice "scout" to the visual perspective necessary for accurate counting. To be effective, worms must be detected in early stages (instars) of growth. At this time, they are "almost" microscopic, and most are similar in color to the crop. While difficult, all cooperators still learned the skills within the first few weeks.

It was of interest to note that most cooperators, when asked what value they acquired from this work, indicated that it was the increased understanding of "what goes on in the field" that they appreciated the most. Growers had little difficulty accepting the use of a biorational and understanding its mode of action. Several, who began using the material without a surfactant at season's onset, quickly adopted one and reported better performance. In one case however, it was believed to be the cause of leaf burn where the cabbage was sprayed during the summer heat. When asked if they were likely to continue using one or more of these low-input procedures in the future, cooperators were generally positive in response, though they suggested they might cut corners on the scouting procedure by sampling fewer plants.

In onion trials a very light crop stand was obtained in the study, and while scouting procedures were followed, populations of onion thrips never approached threshold levels requiring treatments. Because routine applications of pesticides were not made, input costs were reduced by the use of an economic threshold to trigger treatments.

The results of all the applied oil trials in sweet corn taken together suggest the following generalizations:

- The application of mineral or vegetable oils and oil/pesticide mixtures directly to the sweet corn ears can function to reduce damage to the tip area by corn earworm;

- Such applications tend to suppress pollination in the ear tip; however, the area affected is generally small and does not appear to affect marketability;

- There appears to be no clear advantage to either mineral or vegetable oil, though the viscosity of either may make a difference;

- The inclusion of pesticides in the oil, specifically the biological *Bacillus thuringiensis* or the botanical *pyrethrum*, is often more efficacious than oil materials alone; and

- Initiation of treatments as early as 48 hrs after full-brush appears appropriate. (It should be noted that this timing was suggested as optimal by OSU researchers at Lane following the 1989 season.)

While the suggestion that treating individual ears with an oil-can might sound ludicrous to some growers, it was viewed with considerable interest and enthusiasm by most project cooperators. This appeared in part due to the interest in non-synthetic alternatives, and in part to the adaptability of the technique to their scale of operations.

In Arkansas tests for organic production systems, the poorest broccoli cultivars for setting heads were Samurai (28%), Pirate (36%), Raab (47%) and Eureka (48%) at Fayetteville and Samurai (9%), Green Valiant (32%), and Eureka (53%) at Arkadelphia. The significantly smaller heads were grown on Samurai, Pirate, Green Valiant, Raab, Eureka and Futura at both locations. Yet Fusarium Yellows (*Fusarium oxysporum conglutinans*) ratings showed the poorest cultivars for setting heads and head size with the lowest incidence of disease.

In work on micronutrient application on broccoli and cabbage to prevent nutritional disorders in organic systems, preliminary analysis of the results of this study shows that earliness of marketable yield seems to be dependent on both the availability of micronutrients and the timing of applying micronutrients. Statistical analysis showed that the level of preplant fertilizer and the interaction of preplant fertilizer and micronutrient timing was not significant for marketable yield at each harvest and cumulative yield at each harvest. The timing of micronutrient applications was significant for the first two cumulative harvests for both total yield and marketable yield. By the third harvest the cumulative yield was not significant at the 5% level.

Results of these preliminary studies indicate the importance of timing micronutrient applications when using broccoli transplants in soils with potentially limiting levels of these necessary nutrients.

Production results from Texas are currently being summarized and analyzed. A progress report is forthcoming.

(3) Evaluate market/economic viability of LISA vegetable production.

OSU is finalizing the analysis and reporting the results of a carefully designed survey of consumer purchasing preferences for vegetables grown under a conventional vs. a reduced input approach with untreated product as a "check." Preliminary results indicated that without treatment-history bias, there was a significant preference for the conventional product. However, when the treatment history was explained, a majority of the consumers chose the untreated or reduced-input products when surveyed in supermarkets.

In late summer of 1989, the Texas Department of Agriculture conducted a study to evaluate the market for LISA products from the perspective of produce buyers. The study was implemented in the form of personal interviews, conducted by TDA direct marketing personnel in seven of the Department's fourteen districts.

The sample included 91 respondents, almost equally distributed between urban and rural markets. The survey was stratified by whether the firm was part of a chain (such as HEB Food Stores or Safeway) or whether the store was an independent operation. In addition, respondents were asked about their annual produce sales volumes to determine the size of the firm with specific respect to produce. Finally, the respondents were asked to provide information regarding their experience as produce buyers to determine any possible difference in attitude according to this variable.

Respondent Characteristics. Close to three-fifths (58%) of the firms were from urban areas with the remainder (42%) from rural parts of the state. Close to the same numbers were found when looking at differences between chain stores (57%) and independents (43%). Most buyers surveyed (49%) were with large firms, i.e., with sales over $250,000. One-third (37%) were medium-sized with sales between $50,000 and $250,000, and the remainder (14%) were small firms -- sales of less than $50,000. Almost two-thirds (63%) of the survey's respondents had been produce buyers for more than six years. Close to one-fourth (23%) had been in the business from between three to six years. The rest (13%) had spent less than three years as buyers.

Familiarity with Produce Terms. Almost everyone surveyed (95%) said they were familiar with the term "conventional" produce. About the same number (93%) also said they knew what kind of produce was referred to by the term "organic." However, "low chemical input" references were not as familiar. Still, seven of ten (69%) said they knew about this type of growing method, while 31% did not.

When asked about how they learned of these terms, most (70%) attributed their knowledge to reading, less than one in ten (7%) ascribed learning to watching T.V., and a very few (4%) had heard of the terms from listening to radio. Almost one-fifth (19%) reported hearing these terms from other sources including friends and co-workers.

Produce Buying Habits. As expected, every buyer (100%) had purchased conventionally grown produce. Two-thirds (61%) also said they had purchased organic produce. And, close to the same number (65%) reported buying low-input produce. There was unanimous agreement on a current demand for conventional produce. However, only

about one-third were as adamant about the demand for either organic produce (35%) or produce grown with low inputs (33%).

Important Factors for Produce Buyers. Freshness and appearance were the two most important factors noted by produce buyers making purchasing decisions for their stores. Almost everyone agreed that these two were "very" important. Price and size were also recognized as being of importance, though not quite as adamantly. Finally, product labeling received reserved notice as being important, although 18% admitted that labeling was "not important" at all.

Current Market for Organics. A slight majority of the buyers surveyed (55%) stated that there was a current demand for organic produce. Unfortunately, the remainder that answered the question (45%) were not as confident about the market. However, when asked about the future of the organic market, the positive response was more enthusiastic. In fact, almost seven in ten (69%) said they believed the demand for organic produce would increase with time, while an additional fourth (25%) said that, at the very least, demand would remain the same. When asked about factors that influence the organic market, the most common response (44%) was the educational level of the consumer. According to the buyers, the more consumers know about organic produce, the more they buy. In fact, this factor ranked higher among buyers than even price (2%) and product freshness.

Current Market for Low-Input Produce. Almost seven of ten (69%) surveyed reported a current demand for low-input produce. Interestingly enough, this was a higher percentage than those saying organics were in demand. Furthermore, the future of low-input produce is expected to be brighter, as 78% thought demand would increase and another one-fifth (19%) said it would at least stay the same. As with organic produce sales, the consumer's knowledge was ranked highest (44%) among factors influencing the low-input market. Price (22%), product freshness (16%) and appearance (15%) were also noted.

Produce Buying Factors. Survey respondents were asked to rate the following factors according to their importance when buying produce overall, regardless of growing method. Buyers overwhelmingly (98%) stated that freshness was of the utmost importance. In addition, the appearance of the produce was also rated very important by the vast majority (93%). The price of the goods was given considerable weight, with three-fifths (60%) saying it was very important and another third (37%) rating it at least somewhat important.

Consumer Awareness of Growing Methods. "Consumers need more information regarding the differences between methods of growing produce," is the message buyers related through the survey results. Most felt that consumers had an adequate grasp of conventional growing methods with three-fourths (77%) saying consumers were either very or somewhat aware.

However, buyers perceived consumers' awareness of organic and low-input growing methods to be weak at best. More than half (58%) in the case of organic produce and seven of ten (71%) in the case of low-input produce, said more education was required to support increased demand.

Effectiveness of Labeling. In general, produce buyers said that labeling produce is an effective means of educating consumers. Regardless of the method of labeling, more than nine of ten (95%) said that labeling is either very or somewhat effective. There was a slight preference for display labeling over labeling on packages. And, labeling on the product itself was rated least effective of the three methods listed.

Benefit of Certification Program. A certification program was noted as having somewhat of a benefit to organic produce sales. Three of five buyers (60%) stated this improved their sales. The remainder (40%) were not as adamant about such a program.

Buyers' Personal Produce Consumption. Nine of ten (91%) of buyers said they purchase conventionally grown produce for their own consumption. Less than half of that number (42%) said they purchased organic produce for their own tables. But, more than half (57%) reported that they bought low-input produce for this purpose. However, less than three-fifths (58%) said they actually preferred conventionally grown fruits and vegetables. The remainder (42%) admitted to preferring either organic or low-input produce.

Produce Sales Percentages. Conventionally grown produce remains the mainstay of all produce sales. While there was some variability in the percentages of sales of each type of produce, buyers indicated that conventional produce accounts for an average of 92% of their sales. Overall, organic produce sales averaged only 4% of total sales. However, while organic sales are currently just a small percentage of total produce sales, there is some optimism regarding their future. Close to half of those surveyed (49%) said they expected the percentage of organic sales to rise in the future. And, an even greater number (56%) said the same for low-input produce.

(4) Identify and evaluate financial management strategies to help vegetable producers make the transition to the use of LISA production methods.

The following provides a brief look at the operation of rural micro-enterprise programs in three different states which have potential for financing and otherwise supporting sustainable agriculture. The programs incorporate different ideas that specifically apply to the areas which they serve.

Case One: Micro Industry Credit Rural Organization, Tucson, Arizona, Frank Ballesteros, Director.

The purpose of this micro-enterprise development project is to create a revolving loan fund to extend credit and management assistance to micro-enterprises that do not have access to traditional credit mechanisms. The main objectives of the program are to increase the incomes and standards of living of program participants, decrease underemployment and create new jobs, and to reach a large number of informal sector/micro-enterprises for the poor.

Micro Industry Credit Rural Organization (MICRO), completed two full years of operation as of December 31, 1988, with technical assistance from ACCION International, an independent non-profit organization whose business development programs create employment opportunities and a better quality of life for low income families in Latin America. MICRO

has followed the same strategies in rural border communities in the southwestern United States.

MICRO has a distinctive economical and cost effective method of providing essential management, credit and organizational assistance to self employed businesses in four target areas. Operating in Douglas, Nogales, Patagonia, San Luis, Arizona and in Calexico, California, MICRO is breathing life to micro businesses through (1) credit assistance through an innovative revolving loan fund; (2) training workshops and business seminars; and (3) micro enterprise associations.

In delivering the economic base of micro-enterprises in the targeted rural towns, MICRO is providing the missing ingredients that can transform a rural micro enterprise into a valuable business, creating job opportunities and increasing the economic base of the rural town. The difference between success or failure in many cases, translates to two very important factors, credit and management assistance. For 75% of the micro enterprises in the Southwestern United States, operating capital and lack of management assistance remain the two major obstacles to future self-sufficiency.

Case Two: Iowa Department of Economic Development, Des Moines, Iowa, Burt Powley, Training Liaison.

Self-Employment Loan Program -- the purpose of the Self-Employment Loan Program (SELP) is to provide loans to low-income persons to establish or expand small business ventures. Individual loans of up to $5,000 are available at rates that will not exceed 5 percent simple interest per year. Applications must also list a local sponsor; someone who can assist the applicant with their business plan and provide valuable, ongoing business consultation. Appropriate local sponsors may include the Small Business Development Centers, Job Training Partnership Act (JTPA), Women's Economic Development Group Enterprises (WEDGE), Institute for Social and Economic Development (ISED), local chambers of commerce, or other organizations approved by SELF staff.

Appropriate technical assistance provided may include but is not limited to consulting; training and apprenticeship; professional services; assistance in furnishing information about available financial or technical assistance; evaluating small business venture proposals; completing viable start-up or expansion plans; and completing applications for financial or technical assistance. In most circumstances these services are provided at no expense to the individual.

Case Three: North Carolina Rural Economic Development Center, Inc., Raleigh, North Carolina, William Bynum, Director.

The North Carolina Rural Economic Development Center, Inc. is conducting a demonstration project examining the use of micro-enterprise loan funds to generate employment, enhance incomes and spur economic development in rural areas. The major focus of the Rural Center's work during its first year was financing for small and medium-sized businesses in rural areas. A survey of hundreds of rural leaders and rural residents across North Carolina identified small business financing as the leading perceived barrier to

economic development. North Carolina has, however, a strong commercial banking system and several quasi-public development finance institutions. The history of public business financing initiatives has also been mixed, with a tendency to either displace market financing or make bad investment decisions. The center therefore decided to undertake the first comprehensive capital needs analysis in the state's history to determine if a problem existed and, if so, the exact nature of the problem.

The study found that in North Carolina, as in other states, small business plays an important job generation role. North Carolina generally lagged behind the nation in the rate of small business formation, particularly those owned by women and minorities. A major barrier is the lack of equity and near equity financing for small and medium-sized businesses, particularly in rural areas. The report also found a lack of higher risk financing to finance growing firms with little collateral. The central recommendation of the report was the creation of a comprehensive finance system in North Carolina to solve these capital gaps.

(5) Develop and implement educational programs to transfer LISA production and marketing technology to growers and promote products grown in LISA production systems to consumers.

The Oklahoma cooperators provide the best example of diffusion of information. However, other cooperators are also implementing educational programs in a similar manner.

Cooperators in Oklahoma have submitted a manuscript to the American Journal of Alternative Agriculture which includes results from this project. And they have presented results in professional meetings. And as mentioned previously, Roberts and Cartwright (1990) published an Experiment Station report P-911, "A Reduced Input Approach to Cabbage Production: Managing Erosion, Fertility and Pests." Other such reports which are available to the public are being generated.

Wes Watkins Agricultural Research and Extension Center also has had several field days for producers, and other interested parties, from the surrounding region. Associated tours demonstrated the results of our cooperative LISA vegetable systems project. Finally, and most important, in a collaborative effort with the Kerr Center for Sustainable Agriculture, producers of the region conducted on-farm demonstrations based upon applied research from this project conducted at the Wes Watkins Center.

Project Duration: Eighteen months starting March 1, 1989

Funding: $121,989 in 1989. Matching, $67,500.

Organization	Sustainable Agri. Funds	Matching Funds
Oklahoma State University	$24,700	$8,500
Kerr Center for Sus. Ag.	16,500	9,250
Texas Ag. Ext. Service	25,200	22,750
Texas Dept. of Agriculture	22,900	16,500
University of Arkansas	22,800	4,750
Winrock International	7,900	5,750
Totals	$121,989	$67,500

LS89-16: DEVELOPMENT OF A LOW-INPUT MULTIPLE CROPPING SYSTEM FOR SMALL-SCALE FARMS (89-70-5)

Final Report

Major Participants:

Southern University, Louisiana: Owusu Bandele (Co-Project Coordinator, Overall Coordinator), Horticulturist, Center for Small Farm Research, Agriculture and Mechanical College, P.O. Box 10010, Baton Rouge, LA 70813, Phone: (505) 771-2011, responsible for all plant-related aspects of the project including supervision of plot establishment and maintenance, data collection, statistical analyses of yield data; Adell Brown, Jr. (Co-Project Coordinator), Extension Agricultural Economist, Cooperative Extension Service, responsible for all economic analyses, also responsible for supervision of the extension component; Yemane Ghebreiyessus, Soil Scientist, Department of Plant and Soil Sciences, co-investigator, responsible for soil fertility aspects of the project and responsible for quantifying soil losses from erosion.

Southern Development Foundation: Wilbert Guillory, Farm Manager, SDF Farm, supervises land preparation, plot maintenance, irrigation, and related duties at the research site on the SDF Farm and assists in contacting local growers relative to the project.

Farmer Participation:

Mr. Wilbert Guillory, farm manager of the SDF's 350-acre farm, has been involved in the project since its inception. Currently, ten small-scale African-American farmers utilize the farm for the production of a variety of vegetables. As noted above, Mr. Guillory supervises land preparation and plot maintenance for the LISA project component located on the SDF Farm. Through his efforts, SDF has provided land, farm equipment (tractors, disks, sprayers, etc.), irrigation, and manpower to the

project. Because he is well-known and respected through central Louisiana for his efforts to assist small-scale producers, he has been instrumental in bringing this project to the attention of both producers and professional agricultural personnel in the area.

Mr. Clarence Audoin is a small-scale vegetable farmer at SDF who is responsible for the day-to-day maintenance and production practices carried out at the LISA site located on the SDF farm. He assists in all operations including land preparation, planting, irrigation, spraying, and harvesting/grading.

Dr. Gary Simon, a former extension agent, is a part-time farmer in St. Landry Parish. He has been consulted on numerous occasions concerning the project, and has provided invaluable input regarding crop selection, marketing potential, and cultural practices of the area's small-scale producers. Dr. Simon is also well-known in the area, and has attempted to assist local farmers with both management and marketing. He has also been instrumental in bringing attention to the project.

Note: All three farmers can be reached at the following address: Care of Southern Development Foundation, Route 4, Box 331, Opelousas, LA 70570.

Overview

A cropping system was developed in which various vegetable crops are planted sequentially with legumes strategically placed within the sequence to build up soil nitrogen (N) and allow for low-inputs of expensive N fertilizer. Fall-planted leguminous cover crops of hairy vetch, Austrian winter pea, and crimson clover were each followed by spring-planted 'Sundance' summer squash and 'Dasher' cucumber. Squash and cucumber crops were followed by 'Florida Broadleaf' mustard green and 'Vates' collard, respectively. The same vegetable sequences were also planted without benefit of cover crop. Three nitrogen (N) rates were applied to each vegetable crop: (1) the rate recommended by the Louisiana Cooperative Extension Service; (2) one half that rate; or (3) none. The experiment was repeated for three years at two locations in Louisiana, Southern University, Baton Rouge, and the Southern Development Foundation's Farm in Plaisance. The cover crop effect was usually greater with the spring-planted vegetables. Squash and cucumber following crimson clover and hairy vetch generally produced greater yields than those vegetables grown without preceding cover crop. The performance of Austrian winter pea was variable and was apparently adversely affected by wet conditions during 1991-1992. As a result, squash following Austrian winter pea in 1992 produced smaller yields than did squash following the other cover crops. Cover crops effects for fall crops while inconsistent, were greatest in the fall, 1992 when mustards following crimson clover and hairy vetch produced greater yields than other treatments. This trend was also noted with the collard crop. The complete elimination of N fertilizer resulted in reduced yields for all crops. However, yields of crops receiving one-half the recommended N were generally comparable to those receiving the full recommended rate regardless of previous cover crop. Results of this study demonstrate that cover crops can enhance the yields of sequentially planted vegetables, although their usage may not completely eliminate the need for additional N fertilizer. Furthermore, the performance of cover crops can vary from year to year because of climatic and environmental conditions. However, crimson clover and hairy vetch are apparently better choices for cover crops than Austrian winter pea

in Louisiana and the humid southeast. The study also suggests possibilities for reducing N applications for vegetable crops to levels lower than those commonly recommended. Finally, the effects of cover crops beyond the first sequentially planted vegetable crop may take several growing seasons to become apparent.

Project Results

Objective One

Results of this study demonstrated that leguminous cover crops can enhance the yields of sequentially-planted vegetables (summer squash, cucumber, mustard green, collard). Of the three cover crops evaluated, crimson clover and hairy vetch appear best suited for climatic conditions found in Louisiana and the humid southeast. The performance of Austrian winter pea was variable and was apparently adversely affected by wet conditions. Yields of the spring-planted vegetables following the cover crops generally were higher than those grown without the benefit of preceding cover crop. However, their usage may not completely eliminate the need for additional nitrogen (N) fertilizer sources since the complete elimination of N fertilizer usually resulted in reduced yields of the vegetable crops within the sequence. On the other hand, vegetables grown with one half the recommended N rate generally performed comparable to those grown with the full recommended rate regardless of the presence or absence of a preceding cover crop. These findings suggest the possibility for reducing N applications for vegetable crops to levels lower than those commonly recommended.

Objective Two

The economic feasibility of selected cropping sequences is still being assessed. Input costs (labor, fertilizers, chemicals, etc.), and yield data are being analyzed in order to determine differences in economic returns of the selected crop sequences. These data will be used to develop enterprise budgets and make farm recommendations relative to the selected cropping sequences as well as nitrogen fertilizer use. Finally, an effort will be made to determine if the data that was collected is comparable with the Planetor/Budgetor budget generator format.

Objective Three

Research/demonstration plots were established and maintained at two locations: The Southern University Horticultural Farm in Baton Rouge, LA and the Southern Development Foundation's (SDF) 300 acre farm. SDF is a small-scale farm component of the Southern Cooperative Development Fund, an organization with over 20 years experience in agricultural and economic development in the southeast. The farm is located centrally to a large concentration of small-scale farms, many of whom are African-American. Southern University's extension agent for St. Landry Parish was also involved in the project. Numerous farmers visited both sites to observe cover crops and cropping sequences.

Related research will continue beyond the SARE project expiration date. We are evaluating several weed control strategies utilizing cover crops, including low-input

techniques. A split plot experiment has been established using the two best cover crops from the previous experiment. Crimson clover and hairy vetch, which were found to be more consistent in plant growth and subsequent nitrogen content than Austrian winter pea, were seeded in December, 1992. Treatments include bare ground (no cover), and three treatments for each cover crop. These include incorporating the cover and covering the rows with plastic mulch, and mowing the covers and planting vegetables in the remaining mulch. All vegetables will be transplants raised in the greenhouse. Pepper and cantaloupe were transplanted in May, 1993 in the treatments mentioned above. Two nitrogen rates (0, 1/2 recommended N) are being applied. The latter was selected because we found that reducing recommended N rates by one half in the previous experiment generally resulted in crops that did as well as those receiving the full rate recommended by the cooperative extension service. Only the bare ground treatments will receive chemical herbicides. Treatments are replicated three times. A fall crop of collard and cabbage will follow pepper and cantaloupe, respectively. Data will be gathered regarding yield, weed pressure, nutrient status of crops and soils, and economic and labor inputs. Materials and supplies for this experiment were purchased from remaining funds from the original project.

Objectives

(1) To develop viable vegetable sequential cropping systems that are ecologically sound and that minimize the use of agricultural chemicals.

(2) To determine the economic feasibility of selected low-input vegetable cropping sequences for small-scale farmers.

(3) To facilitate low-input technology transfer to small-scale producers by coordinating research and extension efforts through existing small farm organizations.

Resource Development

Three journal publications are being prepared involving yield analysis, economic analysis and nitrogen uptake and utilization. The cooperators gave presentations at eighteen conferences and extension meetings. They attended five additional conferences and wrote two newspaper articles about the project.

Project Duration: Thirty months starting March 1, 1989

Funding: $100,000 in 1989. Matching, $73,000.

Organization	Sustainable Agri. Funds	Matching Funds
Southern University	$100,000	$73,000
Totals	$100,000	$73,000

LS89-17: COMMUNICATION AND INFORMATION SYSTEM FOR LOW-INPUT SUSTAINABLE AGRICULTURE (89-21-6)

Final Report

Major Participants:

Winrock International Institute for Agricultural Development: F.E. Busby, Regional Director, Route 3, Petit Jean Mountain, Morrilton, AR 72110.

University of Arkansas Cooperative Extension: Gail S. Lee, Extension Horticulturalist.

Appropriate Technology Transfer for Rural Areas (ATTRA): Jim Lukens, Program Manager.

Small Farm and Technical Assistance Center (SFTAC): Corbet Lamkin, Head.

East Arkansas Produce Marketing Association (EAPMA): Earl Farr, Administrator.

Ozark Small Farm Viability Project (OSFVP): Gordon Watkins, President.

Meadowcreek Project (MC): Jeff Dickenson, Chairman, Agriculture Department.

Kerr Center for Sustainable Agriculture (KCSA): Teresa A. Maurer, Research Coordinator.

Arkansas Land and Farm Development Corporation (ALFDC): Calvin R. King, Executive Director.

Rodale Institute: Janet Bachmann, Arkansas/South Central States Representative (RI).

Texas Department of Agriculture: Paul B. Martin, Coordinator, Sustainable Agriculture.

Overview

This project will develop a communication and information system for low-input sustainable agriculture (LISA) to serve Arkansas, Oklahoma, and appropriate adjacent areas. The communication and information system will link 18 or more farmer organizations and farmer-supporting institutions and agencies. It will provide communication and coordination among groups and individuals involved in farming extension, technical assistance, and research to facilitate (1) transfer of existing and new LISA information to and from farmers and (2) accumulation of reliable and useful new data on LISA methods. Development will include how to prepare, store, link, and access electronic bulletin boards, print media, and data bases. The project will evaluate the opportunity for including the entire southern region.

Project Results

-Since November 1989, the Network has functioned as an organization with bylaws and officers to promote sustainable agriculture in the region.
-Since September 1989, the Network has published a newsletter that is distributed to over 700 individuals.
-Beginning in 1988, the Network has organized an annual educational conference to encourage sharing of information about sustainable agriculture.
-Provided financial support for research deemed particularly important for the advancement of sustainable agriculture and helped bring together researchers to prepare other successful proposals.
-Served as a referral service for information about sustainable agriculture.
-Co-sponsored with numerous other organizations concurrent sessions on sustainable agriculture and field days to demonstrate sustainable agriculture technology.
-Encouraged participation by farmers and others in the SARE program.

Objectives

(1) Implement the linkages for a LISA communication and information coordination system for this area (ACES, ATTRA, WI, OCES, KCSA, RI).

(2) Develop and maintain mechanisms of communicating LISA information to farmers, research and extension workers, and technical assistance specialists for the network (WI, ACES, OCES, ATTRA).

(3) Develop and test a plan for adapting and expanding the network concept and information system to the total southern region (WI, ATTRA).

Project Duration: Fifteen months starting March 1, 1989

Funding: $31,000 in 1989. Matching, $92,973.

Organization	Sustainable Agri. Funds	Matching Funds
Winrock International	$31,000	$92,973
Totals	$31,000	$92,973

LS89-18: COMPOSTING POULTRY LITTER -- ECONOMICS AND MARKET POTENTIAL OF A RENEWABLE RESOURCE (89-9P-1)

Final Report

Major Participants:

North Carolina State University: L.M. Safley, Jr. (Project Coordinator), Biological and Agricultural Engineering, Box 7625, Raleigh, NC 27695-7625. James C. Barker, Biological and Agricultural Engineering; S.L. Warren, Horticultural Science; T.A. Carter, Poultry Science; Philip Westerman, Biological and Agricultural Engineering; C.D. Safley, Economics and Business; J.P. Zublena, Soil Science.

Overview

Broiler and turkey production are major agricultural industries in the Southeastern region of the United States. Production facilities are typically concentrated within a reasonable haul distance of a processing facility. Frequently, production facilities are located on farms or in areas with insufficient crop land to assimilate all of the nutrients in the litter. Unless an economical alternative is developed, the nutrient surplus generated in these areas will likely impact the environment in a negative way.

The intent of this project is to conduct a marketing analysis to determine the potential of utilizing composted poultry litter as a renewable fertilizer resource. It is anticipated that properly composted poultry litter will generate considerable demand outside the area of concentrated broiler and turkey production particularly with increasing interests in organic fertilizer. Successful migration of compost outside of the concentrated growing areas will directly reduce pollution and environmental degradation as well as providing an alternative economic enterprise to increase net profitability in the region. If successful this low-input technology could be readily transferred to other broiler and turkey production areas of the country.

Project Results

Poultry Litter Production

Manure was defined in terms of type of poultry production facility (egg layers, broilers, turkeys, etc.). Estimates of both total annual manure production and total annual manurial nitrogen were made for layers, turkeys, broiler breeders and broilers for the top poultry producing counties in North Carolina. In addition, estimates of total annual poultry manure product were made for top poultry production counties in Arkansas, Delaware, Georgia, Maryland, North Carolina, Pennsylvania and South Carolina.

Characterization data from samples analyzed by the N. C. Department of Agriculture and the Biological and Agricultural Engineering Department of North Carolina State University was gathered for turkey, boiler and duck manures and litters. Samples of fresh and composted litter were obtained from several composting facilities located throughout the

United States and evaluated. Analytical results and sample preparation procedures utilized in evaluating the compost samples were developed.

An evaluation was made on how the composting process effects poultry litter nutrient concentrations. In general, nitrogen concentrations decrease and phosphorus concentrations increase during composting. The literature was reviewed and several North Carolina sites were studied to determine the impact of land applying poultry litter. Poultry litter applications made at rates to approximate crop nutrient uptake were found to have little potential for groundwater contamination. The environmental impact of composting poultry litter was estimated to be low given reasonable process design and management.

The concentration of nutrients in composted litter was determined to vary considerably. It was estimated that one ton of composted poultry litter would have the equivalent of 16 lbs of available N, 22.5 pounds of P205 and 20.3 pounds of K20. At current commercial fertilizer prices a ton of composted poultry litter would be valued at $11.39 based on available nutrients. Use of composted poultry litter as a crop fertilizer material will depend on such factors as nutrient concentration and soil nutrient requirement, hauling distance and cost.

Composted Litter as Bedding Material for Broilers and Turkeys

Composted litter has been used as a bedding material for turkeys and broilers on a limited basis. Reasonable success in using this material as a bedding material has been reported. However, the birds produced on composted litter were slightly dirtier than birds produced on fresh shavings. Available information on the use of bedding in different poultry management schemes, the characteristics of certain composted materials and the physical/chemical characteristics of several different materials were summarized.

The characteristics of materials typically used in horticultural container production and those of composted materials were compared. A review of the available literature indicated that compost could be successfully substituted for peat moss in horticultural substrates. Composted poultry litter was estimated to also be a good material for use in the field production of horticultural crops by virtue of its being a stable source of organic matter. Several possible types of outlets for the sale of composted poultry litter were identified. It was estimated that the North Carolina horticultural container industry could easily use nearly 500,000 cubic yards of composted poultry litter annually. Potential annual use of composted poultry litter in production of horticultural field crops in North Carolina was estimated to be approximately 180,000 tons. Information was compiled on the number of certified nurseries and the certified nursery acreage for several states within reasonable transport distance of North Carolina.

Economic Analysis of Alternative Composting Systems

Six alternative composting system options for processing poultry litter were evaluated. The options considered covered both on-farm and commercially sized production facilities. The systems studied included windrowed piles with different turning frequencies and techniques, static aerated piles and in-vessel technology. Detailed enterprise descriptions (labor, land and equipment) and annual production budgets were developed for each system

studied. All assumptions and input data used in developing the descriptive models are presented. Total production costs per ton of bulk output for the on-farm systems studied varied form $17.76 to $14.84. For the commercially sized systems studied the total production costs varied from $19.91/ton to $29.42/ton. Various factors to consider when planning a compost system were considered.

As a result of this study the authors conclude that composting poultry litter is a potentially attractive waste management alternative that produces a readily useable and highly flexible product for on-farm, horticultural and residential use. Additional research is needed to better define system parameters and management and to assess the market value of the composted material. The following ideas for future research are suggested:

1. Conduct pilot-scale and in-field composting trials for different types of poultry litters to determine appropriate initial product blends and system management requirements.

2. Evaluate the horticultural values of composted poultry litter to produce plants in both containerized and field situations.

3. Estimate/evaluate potential market for composted poultry litter.

Objectives

(1) To evaluate the economics, engineering and environmental impact of composting poultry litter.

(2) To determine the potential market for composted poultry litter.

Project Duration: Fifteen months (March 1, 1989 to June 30, 1990)

Funding: $15,000 in 1989. Matching, $14,343.

Organization	Sustainable Agri. Funds	Matching Funds
North Carolina State University	$15,000	$14,343
Totals	$15,000	$14,343

LS89-19: DEVELOPMENT OF A PLAN FOR IMPLEMENTING A LOW-INPUT SUSTAINABLE FORAGE PRODUCTION SYSTEM IN THE OKLAHOMA-ARKANSAS OZARK HIGHLAND REGION AND SIMILAR LAND AREAS (89-56P-2)

Final Report

Major Participants:

Soil Conservation Service: Doug Butts, (Project Coordinator) RC & D Coordinator, Soil Conservation Service, Room 108, Federal Office Building, Batesville, AR 72501, (501) 793-6550; Jerry Mitchell; Frank Rowlett; Larry Farris. Mark L. Kennedy (previous project coordinator), P. O. Box 335, Salem, AR 72572, (501) 895-3201.

Arkansas Soil and Water Conservation Commission: Bill McMurry.

Arkansas Association of Conservation Districts: Don Richardson.

Ozark Foothills RC & D Council: Roy Hayden.

University of Arkansas: Tom Riley, Cooperative Extension Service.

Winrock International Institute for Agricultural Development: F.E. Busby.

Rodale Institute: Janet Bauchman.

Cooperating Agencies and Organizations:

Sponsors: Ozark Foothills RC & D Council; Arkansas Association of Conservation Districts.

Cooperating Institutions and Organizations: AG-Renewal, Inc., Weatherford, OK; Arkansas Cattlemen's Association; Arkansas Farm Bureau Federation; Arkansas Forage and Grassland Council; Arkansas Soil and Water Conservation Commission; Heifer Project International; Kerr Center for Sustainable Agriculture, Poteau, OK; Noble Foundation, Ardmore, OK; Rodale Institute; University of Arkansas Cooperative Extension Service; University of Arkansas Agricultural Experiment Station; USDA Soil Conservation Service; USDA Agricultural Research Service, Booneville, AR; Winrock International Institute for Agricultural Development; District Directors for Nine Conservation Districts in the Arkansas Ozark Mountain Region.

Farmer Participants:

Cooperating Livestock Producers/Demonstration Farms: James Rhein, Baxter County; Jim Turnbo, Baxter County; Bill Hunt, Cleburne; Darrell Logan, Cleburne; M.L. Humphries, Fulton County; Lindell McCullough, Fulton County; Roye Scribner, Fulton County; Frank Oliver, Fulton County; Charles Swanson, Fulton County; Harold Ellison, Independence County; Larry Hamilton, Independence County; Tom Williams,

Independence County; Mitchell Dobson, Izard County; C. Edward Tudor, Searcy County; Pat Conner, Searcy County; Randy Long, Sharp County; Pete Rose, Sharp County; Charles Wiles, Sharp County; Dean Himschoot, Sharp County; Roy Hayden, Stone County; Andy Andregg, Van Buren County; L.D. Cox, Van Buren County; Henry Housley, Van Buren County.

Overview

The initial proposal requested funding for the development of a plan to implement a comprehensive, intensive, low input sustainable forage management program with initial emphasis in a nine-county area of the Arkansas Ozark Mountains. As the project progressed, input was received from a very diverse group of people involved in grassland agriculture. These people represented farmers, agricultural businesses, agricultural agencies, organizations, local political leaders and many others. It became very apparent that there was a tremendous opportunity to have a dramatic effect on grassland resource and to improve the local economy.

The sponsors have held a series of meetings, workshops, and field days in an effort to really find out what the problems were that the farmers faced. The sponsors also sent out questionnaires seeking local input. From all the input, it became clear as to what the basic problem was which kept this area from getting the most out of the grassland resource. The average livestock producers in this area are simply not utilizing the abundance of information and expertise available to them. They are not using simple management practices that have been proven through years and years of use in this area, as well as, throughout the world.

Project Results

What the sponsors found is that far too many livestock producers were not using very simple grassland management practices in their operations; practices such as, rotational grazing, use of fire for weed and brush control, low cost electric fencing for cross fencing and use of native grasses and other adapted introduced forage species. It was found that there were several reasons why the grassland management level is low. One reason is that the majority of the producers work at other jobs and don't have time to assess the existing agri agencies that have expertise in grassland management. Therefore, many have no basic knowledge of the management principles. Also, some producers concentrate on some very intense management while letting the simple practices listed above slip by. Some producers do very well in their fertilization programs but do not have the ability to properly graze their grassland.

To disseminate the findings of project, the sponsors have held a series of workshops for farmers and ranchers. The major efforts were annual workshops and printed material from the workshops. Below is a list of the workshops and dates they were held:

DATE	LOCATION	FARMER ATTENDANCE
March 1989	Salem, AR	176
March 1989	Marshall, AR	77
March 1990	Mt. Home, AR	65
March 1990	Salem, AR	180
March 1991	Salem, AR	210
March 1991	Mt. Home, AR	156
March 1992	Salem, AR	250

At each of these workshops, a tour was also held to show in the field how grassland management practices are implemented. The proceedings for the workshops held in Salem were printed and copies distributed to many farmers in the nine-county project area.

Objectives

(1) Establish a plan for implementing the project.

(2) Obtain the necessary funding.

(3) Set in place a mechanism for implementation.

Project Duration: Fifteen months starting March 1, 1989

Funding: $15,000 in 1989. Matching, $38,600.

Organization	Sustainable Agri. Funds	Matching Funds
Planning Grant	$15,000	$38,600
Totals	$15,000	$38,600

LS90-20: EFFECTIVE NITROGEN FOR LOW-INPUT FORAGE AND GRAIN PRODUCTION IN A THERMICUDIC REGION

Major Participants:

USDA/ARS, Southern Piedmont Conservation Research Center: R. Russell Bruce (Project Coordinator), Box 555, Watkinsville, GA 30677, characterization of physical conditions of soil; L.A. Harper, describing nitrogen dynamics in the production systems; G.W. Langdale, conservation tillage assessment; W.M. Snyder, analysis of hydrologic data and modeling interpretive analysis of data; J.A. Stuedemann, planning and execution of animal aspects of project and assisting in preparation of experimental

sites; S.R. Wilkinson, forage management and characteristics of nutrient cycling in forage systems.

University of Georgia: D.A. Crossley, Bio Sciences Building, Athens, GA 30602, characterization of soil biota; N.R. French, Conner Hall, economic analysis; P.F. Hendrix, Ecology Building, nitrogen analysis and nitrogen partitioning in production system, soil biological analysis.

Oconee River Resource Conservation and Development Council: Mac Hayes, Coordinator, Watkinsville, GA. Coordinates activities between the group, farmers, RC & D council and Oconee River Soil and Water Conservation District, sponsors of this project. He will also assist in tours of the project.

Cooperative Extension Service: W.I. Segars, Water Quality Coordinator, Athens, GA. Developing communication techniques to transfer research technology with farmers and other clientele.

Farmer Participants:

Advisory Role: C.D. Dawson, Bishop, GA; G.A. Hilsman, Watkinsville, GA; W. Montgomery, Watkinsville, GA.

Overview

Effective and economical alternatives for meeting nitrogen (N) requirements in crop production are crucial for low-input agricultural systems on thermic Udult soils which comprise the 15.3×10^6 ha Southern Piedmont region. Organic N from animal manure and winter legumes are potential sources for the region; however, management, effectiveness, and economics of these sources are uncertain and merit study. It is proposed that the efficacy of N supplied by these organic sources for grain and forage production be described and compared with a conventional inorganic N source and a combination of organic and inorganic sources. This will be done over a 3-year period on small watershed and farm field scales enabling a sampling of daily rainfall distribution and its impact on N efficacy of the sources, as well as assessment of cumulative treatment effects and economic performance. Experiments will focus on N supply to small grain and forage crops, both animal- and machine-harvested. Effects of animals on water quality in low-input systems will be assessed in a gauged watershed. N inputs will be accounted for and their availability and synchronization with crop needs will be described.

A diverse team of participants will be involved, including farmers, technology and information transfer persons, commercial producers, and research scientists. All participants are committed to accomplishment of all project objectives, from planning experiments to technology transfer.

On two watersheds, P1 and P2, crimson clover was no-till planted in the fall of 1990 and 1991. A pattern of points was established on each watershed for sampling crops and soils. On each watershed forage millet was no-till planted into the clover in May and

harvested as hay in 1991. A preliminary nitrogen budget for P1 in the May through September 1991 period shows that about 100 kg/ha N was mineralized from soil and legumes sources and that the same amount was harvested in millet. However, analysis of soil samples taken in 1990, 1991 and 1992 from P1 to a depth of 2.9 m indicated that concentrations of nitrate near 20 mg ha -1 were commonly found between depths of 1.4 and 1.7 m. A similar zone of elevated nitrate concentration was not found in P2. It is, therefore, concluded that the current crop culture is efficiently utilizing the available mineralized N in hay production.

Objectives

(1) Describe the efficacy of organic and inorganic sources of N in forage production with animal and machine harvesting in intensive studies at experimental watershed and farm field scales.

(2) Evaluate the potential for surface and groundwater contamination by the systems studied in Objective 1.

(3) Describe the economic characteristics of the various N management systems.

(4) Through farm scale research and communication with farmers and technology transfer agencies, conduct technology transfer programs for efficient N management systems.

Project Duration: Three years (March 1, 1990 - February 28, 1993)

Funding: $195,000 in 1990. Matching, $538,200.

Organization	Sustainable Agri. Funds	Matching Funds
USDA/ARS	$73,044	$358,000
University of Georgia	121,956	180,200
Totals	$195,000	$538,200

LS90-21: AN EDUCATIONAL PROGRAM IN LOW-INPUT SUSTAINABLE AGRICULTURE PRODUCTION TECHNOLOGY AND PHILOSOPHY

Final Report

Major Participants:

University of Florida: Timothy D. Hewitt, Florida Cooperative Extension Service, North Florida Research and Education Center, 3925 Highway 71, Marianna, FL 32446. Stephen A. Ford, Food and Resource Economics Department, 1109 McCarty Hall, Gainesville, FL 32611.

Clemson University: Jere Brittain, IPM Coordinator, 265 Poole Agricultural Center, Clemson, SC 29634.

Auburn University: Jerry Crews, Department of Agricultural Economics, Auburn University, AL 36849-5639.

Georgia Experiment Station: William Hargrove, Griffin, GA 30223-1797.

Overview

There is a wide variety of perceptions of the meaning of low-input, sustainable agriculture among agricultural industry leaders. Consequently, there is an obvious need for an educational program directed at agricultural leaders from all sectors in agriculture in Alabama, Florida, Georgia, and South Carolina. The clientele would include agricultural policy makers, leaders of farmer organizations and commodity groups, university administrators, researchers, and extension workers. This proposal suggests holding a two-day conference to introduce this clientele to current LISA technology and its uses in order to enhance the possible adoption of this technology and the support (both monetary and legislative) it receives from the agricultural industry.

Project Results

A regional workshop on sustainable agriculture was held in Tifton, Georgia on October 8-9, 1991. Attendance at the conference was 115 participants. Represented at the conference were: producers, university administrators, researchers, extension specialists, extension agents, soil conservationists, industry personnel. Seven states were represented: Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee. Extension agents that participated represented: Alabama (9 counties), Florida (6 counties), Georgia (15 counties) and South Carolina (8 counties).

The workshop was geared so that information on the concepts and practical applications of sustainable agriculture would be shared with producers and extension personnel. A proceedings was distributed at the meeting for future use of the information, possibly at county level producer meetings. Information obtained from the workshop has been used at county extension meetings. Those agents who have responded to a request for

information report the following use at producer meetings: Alabama (4 county meetings), Florida (2 county meetings), Georgia (7 county meetings), South Carolina (4 county meetings).

General subject matter that was included in the workshop includes: Perceptions of agricultural sustainability; sustainable agriculture policy; effects of sustainable agriculture on the farm; soil and water issues; food quality and safety; legal issues, rotations; nutrient management; groundwater protection; water management; environmental issues for animal systems; pesticide stewardship.

Future plans for the information obtained at the workshop are presentations at county meetings, newsletters, additional workshops.

Sustainable agriculture workshops and presentations at professional meetings and regional conferences.

The evaluations of the workshop were very positive. In general, the content of the workshop and the quality of speakers were rated very high. As expected most participants enjoyed having a panel of farmers to discuss their views on sustainable agriculture. Suggestions for improvement included shortening the program, more interactions of speakers, and making it more of a workshop with involvement in the actual program by all participants. Approximately 80% of the respondents of the evaluation indicated they would attend another conference on sustainable agriculture.

Objectives

The overall objective of this proposed educational program is to promote a better understanding of LISA technology and philosophy and to foster the formation of new research and extension interest in this area through a conference for agricultural industry leaders. The intended audience includes industry leaders in the private sector, agricultural researchers and extension specialists at universities, county extension faculty, and government officials responsible for public policy decision.

(1) To educate agricultural industry leaders of the Southeast in the specific technology and philosophy behind low-input, sustainable agriculture.

(2) To provide a forum for the sharing of research and extension information about LISA technological developments that are currently available to farmers or in development.

(3) To provide an opportunity for people involved in agriculture to interact on both a formal and informal basis in order to discuss and develop mutual research and extension interests that may lead to future cooperative work.

(4) To continue the extension and educational facets of this project through the dissemination of printed proceedings of the educational program.

Project Duration: One year (March 1, 1990 - February 28, 1991)

Funding: $18,000 in 1990. Matching, $24,311.

Organization	Sustainable Agri. Funds	Matching Funds
University of Florida	$18,000	$24,311
Totals	$18,000	$24,311

LS90-22: INFLUENCE OF INTEGRATED PEST MANAGEMENT (IPM) ON LOW-INPUT SUSTAINABLE AGRICULTURE (LISA) IN THE SOUTHERN REGION

Final Report

Major Participants:

University of Tennessee: Charles H. Hadden (Project Coordinator), Extension Entomology and Plant Pathology, P.O. Box 1071, Knoxville, TN 37901-1071. Richard E. Caron, 605 Airways Blvd., Jackson, TN 38301, State IPM Coordinator and LISA Project Proposal Committee Chairperson.

Oklahoma State University: Gerrit W. Cuperus, 523 LSW, Stillwater, OK 74078, state IPM Coordinator and LISA Project Teleconference Committee Chairperson.

North Carolina State University: Michael H. Linker, P.O. Box 7620, Raleigh, NC 27695, state IPM Coordinator and LISA Project Publication Committee Chairperson.

Overview

An educational project is proposed wherein the Southern Regional IPM Coordinators develop a plan to merge Integrated Pest Management (IPM) and Low-Input Sustainable Agriculture (LISA) concepts into a practical program which will meet the social, environmental, and economic needs of growers and citizens of the region. Producers will have direct input into this program. Once the plan has taken form, a campaign will be undertaken to make other producers of the region aware of both the philosophy and the methodology of the resulting system.

This project was conceived as a vehicle to begin the process of developing linkages between IPM, which has a rich history in the south, and sustainable agriculture (SA) into a practical program which will meet the social, environmental, and economic needs of growers and citizens of the region. IPM and SA systems share a philosophy of farming. SA systems have a strong cropping systems background. IPM concentrates on managing pests. An integrated program can result in a system which can strengthen both systems.

To accomplish this, a video teleconference and a publication was completed. The video conference showed examples of IPM projects and how they might fit into SA. Callers were allowed to ask questions of a panel. Approximately 100 sites participated with over 2,000 viewers. Of the 200 evaluations returned, all but one were positive (evaluations were received from Costa Rica and Indonesia). Over 100 copies of the video conference were distributed to all 50 states as well as Canada and Mexico.

A publication (The Role of IPM in Sustainable Agriculture) was produced and distributed to all extension offices in the south (3,000 copies). This gives recipients a base to begin discussion and activities. Comments from extension agents and specialists indicate that the publication has served as the basis for discussions and meetings concerning IPM and SA. Agents have been especially grateful to have this publication to use as a reference.

Project Results

The overall objective of this project was to increase awareness of the linkages between IPM and sustainable agriculture by initiating discussions of both programs and their commonality of purpose. Initially, a video conference was held and broadcast nationally. Viewers were shown examples of IPM effects and how those projects could fit into SA programs. A panel was available to answer questions by callers. This project initiated much discussion among professionals in the region.

A publication was used as a follow up to the video conference. The Role of IPM in Sustainable Agriculture was printed (3,000) and distributed to all extension offices in the southern states. This provides extension agents with a reference source to help them explain the linkages between IPM, which has a history of strong acceptance in the south, and SA, a concept not yet understood by a majority of growers.

Objectives

(1) To plan an educational program incorporating IPM concepts into LISA programs of the Southern Region.

(2) To assemble and publish region-wide information on the merger of IPM and LISA systems.

(3) To conduct a nationwide satellite video conference on the incorporation of IPM and LISA systems (with the completion of objectives 1 and 2).

Project Duration: One year (March 1, 1990 - February 28, 1991)

Funding: $25,000 in 1990. Matching, $55,500.

Organization	Sustainable Agri. Funds	Matching Funds
University of Tennessee	$25,000	$55,500
Totals	$25,000	$55,500

LS90-23: A MID-SOUTH CONFERENCE ON LISA-RELATED AGROFORESTRY PRACTICES AND POLICIES

Major Participants:

Winrock International Institute for Agricultural Development: Douglas Henderson and F.E. Busby, Route 3, Box 376, Morrilton, AR 72110.

Overview

Agroforestry systems offer farmers practical land-use alternatives for marginal agricultural lands beyond high-input agriculture and low-output forestry systems. Agroforestry technologies help farmers diversify production, improve ecological sustainability, and increase economic productivity. Agroforestry concepts and practices need to be encouraged in the mid-South as part of mainstream agricultural practice, research, and extension.

To accomplish this, Winrock International Institute for Agricultural Development convened a 3-day conference in October 1990 on agroforestry practices and policies for the mid-South states. The conference will bring together innovative farmers, researchers, and extension personnel from public and private institutions in the mid-South to discuss opportunities and mechanisms for strengthening LISA-related agroforestry strategies by agricultural extension and forestry landowner assistance agencies. Participants will share state-of-the-art agroforestry information and examine policies for encouraging development and adoption of LISA-compatible agroforestry technologies and programs.

The conference will result in the establishment of a mid-South Agroforestry Network, and the published conference proceedings will contain the most current available information on agroforestry technologies, research, and extension activities within the mid-South states. A regional directory of practitioners and researchers in agroforestry and related activities will also be prepared. Both the conference proceedings and directory will be distributed to participants and to state, federal, and private organizations.

Objectives

Winrock International proposes to plan and conduct a 3-day conference on agroforestry practices, research, and policies related to low-input, sustainable agriculture (LISA) in the mid-South states of Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Missouri,

Oklahoma, Tennessee, and Texas. This conference will give innovative farmers, researchers, extension personnel and specialists from public and private institutions opportunities to:

(1) Share state-of-the-art information on LISA-related agroforestry concepts, research, and practices for the coastal plain, Mississippi Delta, and upland regions of the mid-South US.

(2) Promote agroforestry research and extension strategies, emphasizing multidisciplinary and collaborative activities.

(3) Discuss the economic and environmental benefits that low-input agroforestry strategies bring to farmers and rural environments.

(4) Examine policies affecting the development and adoption of LISA-compatible agroforestry technologies and programs.

(5) Encourage stronger programmatic emphasis on LISA-related agroforestry strategies by agricultural extension and forestry landowner assistance agencies in the mid-South states.

(6) Establish a mid-South Agroforestry Network to link farmers, researchers, extension personnel, non-governmental advisory agents, and policy makers involved in agroforestry.

(7) Improve communication through participation in a directory of agroforestry practitioners and researchers produced in association with the conference.

Project Duration: One year (March 1, 1990 - February 28, 1991)

Funding: $18,000 in 1990. Matching, $46,495.

Organization	Sustainable Agri. Funds	Matching Funds
Winrock International Institute	$18,000	$46,495

LS90-24: DEVELOPMENT OF AN ENVIRONMENTALLY SAFE AND ECONOMICALLY SUSTAINABLE YEAR-ROUND MINIMUM TILLAGE FORAGE PRODUCTION SYSTEM USING FARM ANIMAL MANURE AS THE ONLY FERTILIZER

Major Participants:

University of Georgia, Coastal Plain Experiment Station: Joseph C. Johnson, Jr. (Project Coordinator), Coastal Plain Experiment Station, P.O. Box 748, Tifton, GA 31793. G. Larry Newton; Jessica G. Davis-Carter; George Vellidis. Dale H. Carley, Georgia Experiment Station, Griffin, GA 30223-1797; William A. Thomas, Cooperative Extension Service, Coliseum, Athens, GA 30602; Randall D. Hudson, Cooperative Extension Service, Rural Development Center, P.O. Box 1209, Tifton, GA 31792.

USDA/ARS: Robert Hubbard; Richard Lowrance; James L. Butler; Adrain W. Thomas; Alva W. Johnson, P.O. Box 748, Tifton, GA 31793.

University of Florida: Del Bottcher, Agricultural Engineering Department, Gainesville, FL 32611.

Overview

This project proposes to identify, develop and demonstrate some techniques, methods, and systems which can be used to recycle manure to animals through production and consumption of forage crops without negatively impacting the environment. Liquid manure resulting from flush cleaning of dairy cow facilities will be irrigated at four rates each at intervals of 7 to 14 days onto crops grown on land typical of a new dairy site. The crops will include corn and rye seeded into a bermuda grass sod in order to have an actively growing plant cover year-round. Sensitive monitoring and analytical instrumentation will be used to determine the fate of manure nutrients (N, P, K, Ca, Mg and Na) in soil and groundwater when different amounts are applied onto crops. Nutrient utilization efficiencies will be determined for each crop and the total system. Changes in soil nutrient content and soil invertebrate populations will be related to manure application rates and examined for any cumulative effects on sustainability of crop production. Data from all segments of the proposed research will be evaluated and results used to identify manure utilization procedures and crop production systems which have economical soundness, low-input sustainability, and are environmentally safe.

Most research, demonstration and dissemination of information will be carried out at the Coastal Plain Experiment Station; however, important contributions to the project will be made at Anthony's Dairy, Americus, GA, and Masstock Diary, Montezuma, GA. Participants in this project include both University and USDA research scientists, Cooperative Extension Service specialists from a broad array of disciplines, and farmers from two successful dairies.

Using manure application rates to provide a range of 200 to 800 kg N/ha/yr., confirmed that the use of 600 to 800 kg N application rate with the triple crop system (rye-corn-bermudagrass) should be economically attractive to dairy farmers because total dry

matter productions are about double that farmers generally obtain from their usual single crop of corn silage per year grown with purchased commercial fertilizer. Initial data do not show any trend for nematode populations to become a problem with this system. Nitrate N concentrations are increasing due to the manure application at the high rates and the relationship to ground water through deep wells. Water analysis is being conducted.

Objectives

(1) Determine nutrient (N, P, K, Ca, Mg) use efficiency and forage production from various rates of manure application and determine the nutritional value and quality of resultant crops.

(2) Determine nutrient (N, P, K, Ca, Mg, Na) fate in soil and groundwater, and the relationship of the water wetting front to nutrient movement associated with various rates of liquid manure application.

(3) Determine the response of soil invertebrates to application rates of manure and to management practices required in the minimum tillage system.

(4) Determine rates of liquid manure applications which are economically and environmentally sustainable in a year-round system of crop production, develop benefit-cost analyses for the system, and make economic comparisons with alternative methods of producing forage crops.

Project Duration: Three years (March 1, 1990 - February 28, 1993)

Funding: $195,000 in 1990. Matching, $686,258.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$195,000	$686,258

LS90-25: DEVELOPMENT OF FRACTIONATION AND TREATMENT SYSTEMS FOR POULTRY LITTER TO ENHANCE UTILIZATION AND REDUCE ENVIRONMENTAL IMPACT

Major Participants:

University of Georgia: William C. Merka, Extension Poultry Science Department, Four Towers, Athens, GA 30602. Oscar Pancarbo, Environmental Health Program, Food Science and Technology Department; Sidney Thompson, Agricultural Engineering Department; Ronald Atkinson, Extension Agriculture Economics Department, Coliseum.

Overview

The poultry industry is a major agricultural industry in the southeastern United States. It generates more than 25 percent of the agricultural income of Arkansas, Mississippi, Alabama, Georgia, North Carolina, Virginia, Maryland, and Delaware. To increase efficiency, this industry has a tendency to concentrate itself. Production concentration generates more poultry waste than can be safely applied to cropland without environmental degradation. Valuable nutrients are also lost.

This study is being conducted to determine more efficient methods of poultry waste utilization in cropping and livestock feeding systems. Preliminary work has shown that fractionation will recover litter material for subsequent reuse in poultry houses and will produce a fine material with improved handling qualities and increased nutrient concentrations. This study will evaluate the economic potential of litter fractionation for reuse of the coarse material in poultry production and use of the concentrated fines for crop production and ruminant feeding.

Pelletized litter was applied at various rates for corn production compared to ammonium nitrate application. Tests are continuing to provide for a slow release of nitrogen from the pellets. If poultry feathers can be solubilized, mixed with litter and then repolumerized prior to pelleting, the rapidly available nitrogen component can be bound in the keratin matrix, thereby reducing the release rate.

Based on separation studies, a Georgia company has been started whereby separated litter has been utilized to produce either a pelletized range cube for cattle feed of fertilizer. Separation of material has provided a sufficient volume of product to be pelletized for production to be economically viable.

Objectives

(1) Develop a simple, efficient and economical method to separate litter into coarse and fine fractions.

(2) Evaluate the reuse potential of the coarse fraction in broiler houses as litter; this would involve testing the coarse fraction for the presence of important microbial pathogens (bacteria and viruses) and toxicants (metals, pesticides and synthetic organic compounds such as PCBs), and development of a treatment system to eliminate residual pathogens.

(3) Evaluate the use of the fine fraction as a more concentrated fertilizer for crop production; this would include the use of commercial equipment for accurate application, and assessment of production parameters and environmental impact. This fraction will also be thoroughly tested for the toxic elements and compounds, and pathogenic microorganisms discussed above for the coarse fraction.

(4) Compare the economic value of this material and system to conventional commerical fertilizer application methods.

(5) Establish extension education programs through publications, seminars, plot demonstrations, and field days to promote adoption of efficient litter use systems.

Project Duration: Two years (March 1, 1990 - February 28, 1992)

Funding: $141,000 in 1990. Matching, $251,370.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$141,000	$251,370

LS90-26: SWINE WASTE -- LOW-COST ALTERNATIVE TO COMMERCIAL FERTILIZER FOR PRODUCTION OF FORAGE FOR GRAZING CATTLE

Major Participants:

North Carolina State University: J.P. Mueller, Crop Science, Box 7620, Raleigh, NC 27695-7620. R.G. Crickenberger, Animal Science; J.T. Green, Crop Science; J.C. Barker, Biological and Agricultural Engineering; J.P. Zublena, Soil Science.

Overview

Swine production is a major agricultural enterprise in North Carolina and the southeastern United States. Swine waste is traditionally applied to land without regard to nutrient availability or environmental impacts. In recent years, there has been a proliferation of farms on which animals are concentrated and waste is produced year-round. Land for waste disposal must be integrated into an efficient and environmentally sound waste management system. Hog farming operations may be enhanced by including a cattle grazing component, resulting in efficient forage use and additional revenue to farms.

This proposal contains a systems approach to improving agricultural profitability and maintaining environmental quality. A swine waste management-cattle grazing system is being evaluated for its impacts on farm purchased fertilizer needs, on forage quantity and quality, on soil productivity, on animal health and performance, and on environmental quality.

Swine waste management - cattle grazing systems were monitored on two farms and one experiment station in North Carolina during 1992. Controlled, rotational grazing of stocker cattle was carried out on one acre paddocks of bermudagrass. All fertilizer supplied was from the liquid swine waste through a solid set irrigation system. Returns to management, labor and capital have ranged between $300 to $800 per acre during the past five years. Haying management was also introduced into the system to reduce N accumulation which could pose a potential ground water concern.

Objectives

(1) Implement the system on at least two farms where interactions of low-input grass production and controlled, rotational grazing will be monitored.

(2) Monitor groundwater, soil and plant nutrient status as influenced by waste water application.

(3) Develop and document a budget model that considers nitrogen applied, evaporated, unavailable, and recovered in animal weight gain.

(4) Generate producer and public support for implementing the system at additional sites.

(5) Develop educational materials and training programs for use by educational professionals and farmers in implementing the system.

Project Duration: Three years (March 1, 1990 - February 28, 1993)

Funding: $50,000 in 1990. Matching, $126,276.

Organization	Sustainable Agri. Funds	Matching Funds
North Carolina State University	$50,000	$126,276
Totals	$50,000	$126,276

LS90-27: A LOW-INPUT MANURE MANAGEMENT SYSTEM IN ANIMAL HOUSING FOR HOUSEFLY CONTROL, WASTE REDUCTION AND FEED

Final Report

Major Participants:

University of Georgia: D. Craig Sheppard (Project Coordinator and Entomologist), Department of Entomology, Coastal Plain Experiment Station, P.O. Box 748, Tifton, GA 31793. Sidney A. Thompson, Department of Agricultural Engineering, Athens, GA 30602, Engineer; G. Larry Newton, Department of Animal Science, Coastal Plain Experiment Station, Animal Scientist.

Farmer Participant:

Arnold Brogdon, Route 1, Box 24, Alapaha, GA 31622, Egg Producer.

Overview

Manure in caged layer houses poses problems. Two of these are dense housefly populations and manure disposal. Currently, caged layer manure is periodically spread on pastures, or a relatively expensive system is needed to scrape the manure and pump it to a lagoon. The large numbers of flies produced are a nuisance which can bring litigation from neighbors and result in facility closures. Fly control with insecticides is expensive and short-lived. Houseflies rapidly develop resistance to any insecticide widely used. Current pest management systems call for drying the manure. This approach was first developed in California and is not practical in the humid southeast.

The proposed study is necessary prior to on-farm testing of a low-input system that will reduce the bulk of manure by half, essentially eliminate housefly breeding and produce a high quality feedstuff. This system could save a 60,000 hen operation $6,000 for fly control and $5,000 or more in manure hauling each year. The native black soldier fly has shown the potential to accomplish these benefits in experimental and practical situations. We plan to test the engineering principles involved in this system to avoid major problems in a subsequent on-farm test. This system may have application in housing designed for other farm animals.

Progress Results

A 40' long California style caged layer house was designed to utilize the beneficial aspects of black solider fly larvae in a manure management system. In a typically dense, naturally occurring population these larvae totally eliminate house fly breeding and reduce the manure accumulation by half. Also, the soldier fly larvae can be used as an animal feedstuff containing 42% protein and 35% fat.

Our experimental house was designed to control the larvae (whose mass movements can cause problems), and to cause the mature larvae to self harvest for use as animal feed. This was accomplished with a 12" deep concrete basin under each bank of cages. The basin wall towards the walkway was vertical and the wall towards the outside of the house was a 40 degree slope. A 6" PVC pipe was fastened at the top of this slope. Migrating mature larvae, seeking a pupation site were captured as they entered a slit in the pipe. Once in this pipe they travelled until they exited the end and fell in a receptacle. This initial design worked so well it has not been modified. The walkway was kept free of manure and larvae and the self-collection system worked very well. A modification of the commonly used small tractor push out system worked very well to remove manure residue.

Collections of prepupae (mature larvae) were about 0.3 pounds per hen per month during the summer, or a total of 600 pounds from June to December. This would amount to 26,000 pounds for a modest sized caged layer house (20,000 hens) with a feed value of $1,900 or more.

House fly control was excellent. No house fly breeding could be detected during the summer. A very few adults were present and these were probably migrants. The few soldier fly adults noticed at any given time were ovipositing females, and these were never a nuisance.

The house fly control achieved with this system was better than could currently be achieved with Larvadex, which would have cost ca. $2,000 per annum for 20,000 hens.

Reduction in manure residue was estimated to reduce manure hauling costs $3,250, for this hypothetical 20,000 hen facility. Value of feedstuff, plus savings on fly control and manure hauling would be worth over $7,000 to this 20,000 hen operation, or 35 cents per bird. House fly control and reduction of environmental pollution are less easily valued, but are valuable contributions of this system.

Potential economic benefits to the caged layer industry are 36.8 cents per hen, which would be over $4 million annually to Georgia's table egg producers, and proportionally more on a national scale. Environmental benefits near production areas would be much lower house fly numbers, and less abuse to nearby lands and watersheds through overapplication of manure. In some high egg production counties there is inadequate land area for spreading hen manure at the proper rates.

Similar economic and environmental benefits should be readily achievable in swine production systems. A study of this is underway.

Objectives

(1) Determine manure pit design compatible with:

a. periodic manure removal with existing equipment;
b. self harvest of mature soldier fly larvae for feedstuff;
c. preventing larval access to walkways; and
d. shallow flooding for early season housefly control.

(2) Develop an effective low-energy storage systemf or the larval feedstuff.

(3) Determine the palatability of this larval feedstuff to swine.

Project Duration: One year (March 1, 1990 - February 28, 1991 extended through August 1991)

Funding: $18,000 in 1990. Matching, $37,442.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$18,000	$37,442
Totals	$18,000	$37,442

LS90-28: SUBSTITUTION OF CULTURAL PRACTICES FOR HERBICIDES TO CONTROL ANNUAL RYE GRASS AND CHEAT IN SMALL GRAINS

Final Report

Major Participants:

Oklahoma State University: John B. Solie (Project Coordinator), Agricultural Engineering Department. H. Willard Downs and Francis M. Epplin, Agricultural Engineering Department; Thomas F. Peeper, Agronomy Department.

Farmer Participants:

Willard Fox, Rt. 1, Box 26A, Washington, OK. Crops include wheat, cotton, alfalfa and cattle on a medium-sized farm in south central Oklahoma.

Robert Harshman, Rt. 6, Box 178, Stillwater, OK 74074. Wheat and cattle raised on a small, part-time farm.

Don Kirby, Rt. 1, Lamont, OK 74643. Progressive farmer on 3,000 acres produces wheat and uses about 1,000 stocker calves each year in northern Oklahoma.

Ray E. Nelson, RR, Carrier, OK 73727. North central Oklahoma wheat producer with a few cattle.

Don and Cecelia Schieber, Rt. 1, Box 75, Kildare, OK 74642. Northern Oklahoma medium-to large-scale wheat farmers.

H.G. Spivey, Rt. 1, Box 114, Ringling, OK 73456. Southern Oklahoma wheat farmer who uses stocker cattle during the winter.

Al and Harold Westfal, Rt. 1, Box 87, Lahoma, OK 73754. Large-scale wheat and stocker cattle farmers in north central Oklahoma.

Overview

Winter wheat is grown continuously on a large portion of the acreage dedicated to crop production in the entire Southern Region of the United States. Attempts to introduce conservation tillage practices have always led to rapidly increasing infestations of weedy *Bromus*, *Lolium*, and *Hordeum* species. Farmers are increasingly abandoning conservation tillage practices or are turning to herbicides to control these weeds. The introduction of new cultural practices including the modification of existing harvesting and planting equipment is a viable alternative to herbicides for controlling light seeded weedy grasses in small grains.

The proposed research and extension project continues and expands a one-year low-input sustainable agriculture project to develop and demonstrate quickly adoptable cultural methods with substantial potential for preventing pandemic infestations of cheat and annual rye grass, two of the most common grassy weeds found in the Southern Region. Practices include: (1) preventing the return of annual rye grass and cheat seeds to fields during harvesting, (2) increasing the natural ability of wheat to compete against annual rye grass and cheat by using new seeding techniques, and (3) identifying wheat cultivars with greater natural abilities to compete against weedy grasses. A complete economic analysis will be performed to evaluate the economic feasibility of the proposed practices. Farmers have been included in the planning, research and on-farm demonstration phases of the project.

Project Results

Objective 1

Preliminary tests were conducted in 1989 to evaluate the potential of collecting chaff and straw from a harvesting wheat. Results were positive, but the volume of straw collected was so great that we decided to separate the weed seed from the straw.

During the spring of 1990, we designed and constructed a pneumatic collector and conveying system and mounted it on a Gleaner M-2 combine. This device collected weed seed, chaff, and shriveled wheat discharged over the combine shoe and conveyed the material to a trailing wagon, a separator in the wagon to remove the chaff. The modified silage wagon could hold all material collected while harvesting two combine bins of clean grain.

We established experiments in seven farmers' fields containing moderate to severe infestations of annual ryegrass or cheat. The weed seed collector worked as designed. The collector removed up to 410 lbs/ac of annual ryegrass seed and 180 lbs/ac of cheat. At two locations, we used the ultranarrow row grain drill to plant wheat. Seeding rates were 75 and 120 lbs/ac, and row spacings were 3, 6, and 9 inches. There were no significant problems with the weed seed collector.

Field tests, that summer, showed the collector-separator worked and would be practical with some modifications. However, the Southern Region Low Input Sustainable Agriculture Research and Education Program failed to fund the final year of the project, and the principal investigator for this objective took a position at another institution. Consequently, we elected to concentrate our efforts on the other objectives. Work was halted on this objective.

Objective 2

In addition to the LISA grants, the principal investigators were able to secure major funding from several sources to expand and continue research outlined in Objective 2. Research on the objective was initiated in 1988 with a one time grant from the Oklahoma Wheat Research Foundation. Subsequent research was funded in part by the Oklahoma Center for the Advancement of Science and Technology, Oklahoma Wheat Commission and the Southern Region Pesticide Impact Assessment Program. Results are summarized by year, below:

In 1988, averaged over area research locations, ultranarrow row seeding practices increased yields of cheat infested wheat by over 11% and decreased cheat seed production by up to 25%. Results of these experiments were used to plan field experiments under the LISA project initiated in the fall of 1989. Experiments were established at three locations to more completely define the interactions among wheat row spacing, seeding rate, and date of planting on cheat suppression and wheat yield. Experiments were also established at two locations to investigate the influence of the severity of cheat infestation on the benefits derived from manipulating row spacing and wheat seeding rate. Additional experiments were established on farmer participant fields to investigate and demonstrate the benefit of 3 inch row spacing and higher seeding rates on annual ryegrass and cheat suppression and wheat grain yield. It was apparent, based on 1988 research, that water injection was not a practical method for stimulating germination. Subsequent attempts to prime wheat seed failed to improve stands.

In the fall of 1989, five major experiments were established to determine the effects of row spacing, wheat seeding rate, weed seed density, and date of planting on wheat grain yield and weed seed yield. Results of these experiments, harvested in June 1990, showed that narrowing row spacing significantly increased grain yield and could reduce by half the dockage attributable to weed seed. Grain yield increases were as great as 455 lbs/ac in weed free treatments and 410 lbs/ac in weed infested treatments when row spacing was reduced from 9 to 3 inches. Increasing wheat seeding rate in weed infested fields will generally reduce weed seed and significantly increase grain yield. These benefits occur independent of the weed seed (cheat) density at planting. Grain yield increased as date of planting is delayed.

Experiments were conducted at three locations in 1990-91 to investigate the interaction of row spacing, seeding rate, and herbicide treatment on cheat control. Treatments consisted of the herbicides metribuzin and Finesse (a chlorsulfuron and metsulfuron premix) applied at two rates plus an untreated check; three row spacings 3, 6, and 9 inches; two seeding rates and cheat and weed free plots. At one location the combination of metribuzin and reduced row spacing increased wheat yield. At the second location decreasing row spacing increased wheat yield for all herbicide treatments and the check. The Finesse treatments increased wheat yield. At the third location, all herbicide treatments increased yield. Seeding at the higher rate increased yield. At one location the three way interaction of low rate of Finesse, reduced row spacing and increased seeding rate reduced cheat seed yield. At two locations, the combination of increased seeding rate and reduced herbicide rate decreased cheat seed yield. The experiments showed that the combination of planting in narrow spaced rows,

increasing wheat seeding rates, and applying reduced rates on herbicides can increase wheat yields and reduce the amount of weed seed harvested.

During the 1991-92 crop year experiments were established to determine the effects of row spacing, seeding rate and herbicide treatment on annual ryegrass control. Treatments consisted of the herbicides; three row spacings 3, 6, and 9 inches, two seeding rates. Herbicides were required to improve wheat yields. However, reducing row spacing and increasing seeding rate enabled reduction of the herbicide application rate at one location.

Experiments were begun to investigate the effects of wheat cultivars, and row spacing on wheat vegetative growth (for cattle grazing) and grain yield in cheat free and cheat infested fields. The combination of dry weather followed by hail storms produced atypical results.

In the fall of 1992, the second year of the two year experiment to determine if the effect of wheat cultivar, row spacing, and weed infestation was begun. Experiments were initiated at three locations to determine the effect of row spacing on suppression of broadleaf weed, primarily wild buckwheat. Results of these tests will be reported in late 1993.

Objective 3

In addition to the LISA grants, the principal investigators were able to secure major funding from the sources listed in Objective 2 for Objective 3. In addition, they received contributions of equipment and components from Great Plains Manufacturing Company and John Deere Company to expand and continue research outlined in Objective 3. Results are summarized below:

During the first two years of the project, we used ultranarrow row plot drills built at the Agricultural Engineering shop to plant experiments. Only one U.S. manufacturer built a grain drill capable of seeding cereal grains at ultranarrow row spacings. This grain drill was complicated, expensive and was not accepted by farmers. Consequently, we embarked on a program to design grain drill openers that were acceptable to farmers.

During 1990, we designed and tested two grain drill openers capable of placing seed in three inch rows while operating successfully in a wide range of tillage conditions. The opener designs were based on distinctly different concepts. Twenty-four units of each design were constructed and mounted on grain drills designed for the specific opener. These grain drills were extensively field tested on six farmer cooperator fields in the fall of 1990.

One of the designs met the initial design criteria: it could be operated in a wide range of tillage systems, it is simple, and it should be less expensive than conventional grain drill openers. This design used a floating knife opener and spring loaded press wheel to place seed in newly tilled soil. Precision of seed placement depth is similar to current designs. The opener could handle large amounts of crop residue. The grain drill, constructed in 1990, used an air seeder metering unit.

This grain drill was tested at 7 locations including four farmer cooperators' fields. The grain drill successfully planted a wide range of conditions including crop residue. The grain drill plots produced higher grain yields than those planted by a conventional row spacing double disc grain drill at a majority of the locations.

Analysis of previous years' data showed that grain yields were near optimum when planted in 3 inch spaced rows. Planting in 3 inch spaced rows frequently reduced weed seed yield. Yield data from 1990-91 experiments supported these findings. The new ultranarrow row (3 inch) grain drill opener will enable farmers to take advantage of these results.

Major equipment manufacturers, although interested in our research, were unwilling to build ultranarrow row grain drills. They did not believe ultranarrow row planting was compatible with the Conservation Compliance Program. Specifically, they did not think a 3 inch row spacing grain drill could plant in high levels of crop residue. In the fall of 1992, we modified a 7 inch spacing John Deere 9450 press wheel hoe drill to plant in 3, 4, 3, 4...inch row spacing. This grain drill proved capable of planting wheat in high levels of residue and could be operated at high speed. Experiments were established at 8 locations to compare performance of the grain drill with a conventional grain drill and the ultranarrow grain drill described previously. These experiments will be harvested in June 1993.

Objective 4

During 1989-1991 we collected data for economic analysis of the proposed cultural practices, including cooperating farmer surveys. We made economic assessments based on the data collected and developed mathematical models to assist in these analyses.

An analysis of the potential economic returns for planting in ultranarrow rows was conducted. Enterprise budgets were computed for farm sizes of 300 to 1000 acres using the representative farm approach. Use of an ultranarrow row grain drill will increase returns $6.79/ac for the 1000 acre farm, and the grain drill will increase returns $6.03/ac for the 300 acre farm. All data are being presented in a format compatible with the Planetor/Budgetor budget generator. Further analyses are being completed at this time.

Results of five years of research clearly show there are significant agronomic and economic advantages to seeding wheat in ultranarrow rows. In the presence of cheat and in clean tilled fields decreasing row spacing to 3 inches consistently increased grain yield an average of 3 bushels per acre. Weed seed yield was frequently significantly reduced. Increasing wheat seeding had an additive effect on grain yield and weed seed suppression. When herbicides were required, adoption of these practices will often enable the reduction of herbicide application. Grain drill modifications were developed to enable farmers to plant at this spacing in heavy crop residues. Estimated cost of this conversion was less than $1,000 per 10 foot grain drill. Economic analyses showed clearly the advantage to adopting these practices.

Objectives

(1) Use 1988-1989 and 1989-1990 research results to demonstrate the advantages of using more competitive wheat cultivars, increased seeding rates, and ultranarrow row spacing for annual rye grass and cheat suppression in wheat, and continue research to optimize the competitiveness of more competitive cultivars.

(2) Refine the ultranarrow row grain drill opener, designed and tested in 1989, to improve seeding depth uniformity and clod and crop residue clearance.

(3) Provide on-farm demonstrations of the decreases in cheat and annual rye grass populations attainable by catching and removing material discharged from the chaffer (lower cleaning unit) of small grains combines.

(4) Estimate the impact of the alternative weed control methods on per unit production costs, family resource use, machinery investment and net return to a representative farm family, and compare results with corresponding estimates for farming systems which rely on conventional methods.

Project Duration: One year (July 1, 1990 - June 30, 1992)

Funding: $60,000. Matching, $59,320.

Organization	Sustainable Agri. Funds	Matching Funds
Oklahoma State University	$60,000	$59,320
Totals	$60,000	$59,320

LS90-29: AN EXPERT CROP ROTATION PLANNING SYSTEM (CROPS) FOR IMPLEMENTING AND EVALUATING LOW-INPUT CROP AND LIVESTOCK SYSTEMS

Final Report

Major Participants:

Virginia Polytechnic Institute & State University: Nicholas D. Stone (Project Coordinator), Department of Entomology, Blacksburg, VA 24061, Phone: (703) 231-6341. Project leader responsible for overall system design and coordination. Also contributes expertise in the application of systems science and artificial intelligence methods to agricultural problems. John M. Luna, Department of Entomology, coordinates farmer participation in the program and provides expertise in system-level implementation of sustainable agricultural practices; James W. Pease, Department of Agricultural

Economics, responsible for the integration of farm-level economics into the system, oversees the integration of economic simulation models into CROPS; Lee Daniels, Department of Crop & Soil Environmental Sciences, primarily responsible for the incorporation of soil erosion models and estimation into the planning system; John Roach, Department of Computer Science, provides expertise in artificial intelligence and in particular in applying knowledge-based techniques to problems of planning and scheduling.

Overview

Widespread adoption of low-input, sustainable agricultural practices may be the only practical solution to the multifaceted crisis of American agriculture. Although low-input farming systems are increasingly recognized as economically viable and environmentally preferable to conventional, petrochemically based agriculture, the practical problems involved in whole-farm planning have largely not been addressed. Implementing low-input, biologically based farming systems may involve growing new crops, growing old crops in new rotation and with different tillage practices, and learning new techniques for improving soil tilth and ecological pest management. Because of the new management skills and knowledge required, the transition from conventional to low-input farming is generally perceived as an uncertain and risky venture. Furthermore, federal farm programs, and the interdependencies of farming operation often make impractical the adoption of component practices that appear attractive in isolation.

The Research and Extension project proposed here involves the use of artificial intelligence and expert systems to create a computer-based planning tool to help farmers choose whole-farm crop rotations, tillage and pest management practices that help achieve a more sustainable agriculture. Expert systems are excellent tools to deal with complex problems which require the synthesis and application of a broad knowledge base. The proposed system is based on a prototype system called CROPS (Crop Rotation Planning System). It will develop whole-farm crop rotation plans for specific crop/livestock operations. The system will then test and compare the expected economic and environmental performance of the generated plans with alternatives presented by the farmer or alternative plans generated by the system. These evaluations will be based on simulation models of whole farm economics and soil erosion.

The system will be developed in cooperation with two farmers operating diverse crop and livestock farms in the coastal plain and the Appalachian mountain areas. The farmers will provide design advice, will test the feasibility of the system on their farms, and will cooperate with a county extension agent and the project coordinators in designing a farmer training manual and workshop.

Project Results

Progress toward the tasks required to achieve each objective is described below.

Objective 1

We are using a knowledge-based approach similar to that used in some expert systems. This knowledge-based approach relies on qualitative descriptions of goals and relationships but can also incorporate quantitative information when available. Producing a working farm planning tool from the prototype requires the following steps:

Task 1: Compiling a knowledge base to represent low-input and conventional crop production strategies and practices. Knowledge-base entries describing crops in rotation schemes and under specific tillage practices have been developed for corn (for grain and silage), alfalfa, sorghum (for grain and silage), wheat grain, and barley silage. Information included are each crop's requirements for growth, time windows for planting and harvest, expected yields by soil type, and cropping sequences in which the crop can be developed. This knowledge base will be added to throughout the project.

Task 2: Developing a computer representation scheme for individual farms. A graphical and data base representation for farms has been developed which includes (a) user-defined goals, preferences, and constraints on the farming operation; (b) financial information about the farming operation; (c) livestock information: requirements for grain, silage hay, and pasture; (d) farm machinery and labor availability; (e) field maps and data on: locations, sizes, topologies, soil types, crop and pest histories.

Task 3: Developing a planning algorithm to construct potential crop rotations and practices for each field of the farm. This algorithm requires knowledge and information described in Tasks 1 and 2 to develop an overall farm plan that satisfies the requirements of the livestock operation and any financial, production, and operational constraints. The procedure is described by computer scientists as a constraint-based planning algorithm. It puts an overall plan together from smaller pieces (macro-operators), at each step checking that no constraints of the system (e.g., estimates of soil erosion for a sloped field in a corn-small grain-winter legume rotation) have been violated.

Currently, CROPS includes a constraint-based planning algorithm that allows users to specify target acreages for specific crops and ensures that soil erosion estimates are below the maximum soil erosion limits set by the Soil Conservation Service for highly erodible land. The algorithm uses the revised universal soil loss equation model, RUSLE. Work currently near completion will incorporate nutrient management considerations into the planner, as well as economic evaluations. During the 18 months we will refine the planner, incorporating more complexity and improving the system's performance.

Objective 2

The CROPS system has been constructed to provide all the needed inputs for the RUSLE model, and we have initiated the incorporation of computer code from RUSLE to enable CROPS to calculate automatically the required soil erosion parameters to estimate sheet and rill erosion based on crop rotation, soil type, field topology, and tillage practices. The knowledge-base entries defined above (Task 1) will be augmented with all the input requirements for the RUSLE model. These modifications have been designed, but are not yet implemented.

Linkage of CROPS to the WEPP (Water Erosion Prediction Project) model has also begun. WEPP is a process model of soil erosion, able to simulate the erosion or deposition occurring at any point in a field. It is coded in about 12,500 lines of Fortran code, provided to us by cooperators at the USDA National Soil Erosion Research Laboratory. By comparison, the RUSLE equation could be coded in one line. As a result, the WEPP model will be run only once, after a whole-farm plan has been generated. Execution time will therefore be increased by only a minute or so. Most of the data needed to run WEPP are contained in standard SCS soil data bases. However, additional data will have to be obtained from on-site soil samples on our cooperating farms. This will be accomplished later this year. Incorporation of the WEPP model will continue into the second year of the project, and perhaps into the third if substantial changes are made in the code.

Objective 3

Work on this objective will begin in the second year of the project. However work to develop the economic data bases has been initiated recently.

The FLIPSIM-V model developed by J. Richardson & C. Nixon (Texas A & M) will be linked to the CROPS system in the same way it was linked to the COTFLEX system developed by the PC (Stone), Richardson, and colleagues at Texas A & M University. Data describing the user's farm finances will be entered into a financial data base. Inputs required for the FLIPSIM modes include machinery complement, debt structure, labor costs, farm program information, and crop production budgets. FLIPSIM also requires information that will be contained already in the map-oriented field data base or that will be generated as part of the planning process: e.g., number and size of fields and expected yields for specific crops in specific fields.

FLIPSIM will be used to compare alternative farm-level, multi-year plans and will produce a probability estimate of farm survival, and gross and net cash farm income. FLIPSIM includes a function that ranks alternative farm plans based on the probability of receiving different levels of net cash farm income. This ranking and the program's financial comparisons of the alternative farm-level plans will be used by the program and by the user to evaluate the plans generated by the CROPS system.

Incorporation of FLIPSIM will involve initially a series of interviews with our cooperating farmers to develop datasets needed to run the model (Tasks 4 and 5). As described below, these interviews will be completed in the first year of the project.

Objective 4

Tasks 4 and 5: Two farm data bases will be developed in a series of interviews during the first year of the project to describe the two farm operations owned by the cooperating farmers. The farm data bases will include financial data as described above, as well as map-based field information, buildings and facilities, and a description of the livestock operation. An aerial photograph or similar farm map will be digitized into computer format. In some cases, soil types and topology will be determined from soil samples and surveying conducted on site.

Interviews have been conducted with one cooperator, Floyd Childress, III. His farm fields have been digitized and data on soil types have been entered into the computer. Interviews will continue this winter.

Tasks 7-8, 10-11: Evaluation of the CROPS system on the farm and its potential delivery to farmers will be accomplished through the participation of two farmers and one Extension County agent. All three will be integral members of a project design team that will meet regularly to supervise the development of the program, its interface, and to evaluate its progress and utility.

The three cooperators will be provided with a computer (MacIntosh IIsi) to run the software, and will meet during the winter of each year of the project for a demonstration and training session. A working prototype of the system will be demonstrated and subsequently delivered in year two, along with a user's guide and technical documentation. This alpha-test version will be used to detect both programming errors (bugs) and design errors that must be corrected in the next (beta-test) version, to be demonstrated and delivered in the middle of the third year. A final version will be released with revised documentation at the end of the project.

The holistic approach taken in CROPS is not new in concept, but never before has the need for the farm-level approach or the result of using it been so clearly demonstrated. We have identified a gap in the whole problem of implementing sustainable agriculture: the coordination problem that results on a whole farm from looking at environmental problems only on a field-by-field basis.

We have shown that implementing agricultural practices based on crop rotation is not merely a matter of making farm management a bit more complex. The idea that it is worth trading inputs for more intensive management is at the heart of the sustainable agriculture movement. In this case, however, we are dealing with an enormous explosion of complexity. We reduce inputs and environmental risks but are left with a truly mind-boggling problem.

The fundamental contribution of CROPS is that it, in itself, is a paradigm for the implementation of environmentally and economically sound agriculture.

This project is being continued as AS92-4.

Objectives

(1) Develop a computer-based expert system to devise whole-farm crop rotation plans and integrate low-input farming practices.

(2) Incorporate the WEPP soil erosion prediction model to analyze the effects of crop rotation plans developed in Objective 1 on soil erosion.

(3) Incorporate an economic model of a farming operation (FLIPSIM-V3) to evaluate the economic effects of potential farm plans developed in Objective 1.

(4) Evaluate the feasibility of whole-farm plans developed in Objective 1 on two Virginia crop/livestock operations.

Project Duration: Three years (March 1 - February 28, 1993)

Funding: $60,000 in 1990. Matching, $76,281. Funding was received from the LISA program for only the first year.

Organization	Sustainable Agri. Funds	Matching Funds
VPI and State University	$60,000	$76,281
Totals	$60,000	$76,281

LS91-31(139): BIOLOGICAL CONTROL AND ITS ECONOMICS IN THE SOUTHERN UNITED STATES

Major Participants:

University of Florida: J. Howard Frank (Project Coordinator), Entomology & Nematology Department, Bldg 970, Hull Road, Gainesville, FL 32611-0740, Phone: (904) 392-1901 x128. Richard N. Weldon (Co-project coordinator), Economics of Biological Control, Food & Resource Economics Department, 1157 McCarthy Hall, 32611-0141, Phone: (904) 392-1848; Frederick D. Bennett (Co-project coordinator), Biological Control Information, Entomology & Nematology Department, Phone: (904) 392-1901 x127.

Overview

Classical biological control (otherwise known as inoculative biocontrol) is the ultimate low-input form of pest and weed control in low-input sustainable agriculture. However, economists have not usually participated in biocontrol research projects, whose advantages, thus, have seldom been proclaimed except by biocontrol researchers. This probably is the

main cause of the weak link between extension and biocontrol research. The weak link has prevented benefits of biocontrol research from being brought to their full potential.

In December 1990 a thorough review of classical biological control research in the southern United States was published. Because it is printed, it cannot include results of current and future research. Also, it lacks economic analysis and is not in a form directly usable by extension specialists.

This proposal will supply current and future biocontrol information to extension specialists throughout the Southern Region by means of a computerized data base. Information which extension specialists will be able to obtain directly from the data base by computer-modem link will be in a form usable to them: it will include economic analyses to be derived from existing, published and unpublished data, by economists. The data base will also provide information to researchers in economics and in biocontrol, generating interdisciplinary collaboration in an ongoing effort to make the available information more complete (it should also promote training opportunities for graduate students).

Objectives

(1) To use partial budgeting to analyze the economics of classical biocontrol researched and developed in the Southern Region.

(2) To expand an existing computerized data base on biocontrol so that all available information from or relevant to the Southern Region is entered, including the results of the economic analyses.

(3) To make this information available to potential users throughout the Southern Region on a read-only basis by computer-modem link, and keep it updated.

Project Duration: Three years

Funding: $49,970. Matching, $180,869.

LS91-32(185): ECONOMICALLY VIABLE PRODUCTION OF VEGETABLES IN THE SOUTHERN REGION USING LOW-INPUT AND SUSTAINABLE TECHNIQUES: A DATA BASE

(Revised 4/93)

Major Participants:

North Carolina State University: M.M. Peet (Project Coordinator), Dept. of Horticultural Science, Raleigh, NC 27695-7609, Phone: (919) 737-3167.

Cooperators:

Extension: Dr. Mike Linker, IPM Coordinator

Mountain Horticultural Research Station: Dr. Greg Hoyt, Assoc. Prof. Soil Science (Research), Fletcher, NC.

Overview

There are few publications available for farmers, extension workers, teachers, researchers or students who need technical information on commercial vegetable production in the southeastern US using reduced-input or organic methods. In order to produce this type of publication, we propose to compile a data base of information on fertilizers, cover crops, rotations, cultivar resistances and IPM (Integrated Pest Managment) protocols. This information will be made available as a Manual on vegetable production. In order to make the content and format of the Manual useful and accessible to farmers as well as the other potential users, in the first year of the proposed project grower groups will be canvassed for their input. Individual farmers will be identified as resources for experiential information, reviewers and possible candidates for inclusion in a later companion volume of case studies (not included in this proposal). The bibliography and data base used to compile the Manual will also be made available.

Data base information will come from: 1) computerized searches of The Alternative Farming Systems Information Center (AFSIC) at the National Agriculture Library and Appropriate Technology Transfer for Rural Areas (ATTRA), 2) a bibliography compiled several years ago at NCSU, 3) popular gardening literature, 4) older vegetable production literature, 5) descriptions of reduced-input vegetable production in non-western countries, and 6) visits to research and educational centers specializing in alternative methods of vegetable production and attendance at meetings on sustainable agriculture. Material collected will be edited for relevance and reliability and organized by crop.

Final development of the data base, publication and distribution will be coordinated with the LISA Information Delivery Network and LISA Subject Matter Committees. Preliminary work will begin on a companion case-study volume to the Manual, but funds are not requested here for full development of this publication.

Objectives

(1) Determine the best content and format to make a Manual on reduced-input vegetable production useful to farmers and extension workers as well as researchers, teachers and students. Identify particular farmers as resources and/or reviewers for the Manual. Timetable: 0-6 months.

(2) Compile data base of information on commercial production of vegetables in the southeastern US using reduced-input and organic techniques such as organic fertilizers, cover crops, rotations, cultivar resistances and IPM protocols. Timetable: 0-18 months.

(3) Evaluate the material compiled for usefulness and reliability and organize into a production Manual for the major vegetable crops grown in the southeastern US. Timetable: 6-20 months

(4) Disseminate data base electronically, as prescribed by the LISA Information Delivery Network, standardizing language and descriptors. Recipients include the National Agricultural Library Alternative Farming Systems Information Center (AFSIC) and Appropriate Technology Transfer for Rural Areas (ATTRA). Timetable: 18-24 months.

(5) Disseminate data base in hard copy form through the publication of an annotated bibliography and through a Vegetable Production Manual. Timetable: 20-24 months.

Progress on Objectives

OBJECTIVE 1:

Format: One of the early decisions on this project was whether to concentrate on an electronic or hardcopy format for the final product. Potential end-users of the database were contacted to determine their access to computing resources. Based on these inquiries, it was decided to initially concentrate on a print rather than electronic version of the manual. Work is continuing on an electronic informational retrieval system, however, which will complement the printed copy.

Content: Areas in which farmers either had particular problems, such as weed control, or in which they were particularly interested, but had difficulty finding information about, have been identified. For example, farmers who identified themselves as 'organic growers' were particularly interested in information on soil solarization and living mulches.

OBJECTIVE 2:

Vegetable crops covered in the database are: beans (including limas, snapbeans and southern pea); cole crops; sweet corn; eggplant; watermelon; okra; peppers; pumpkins; squash; sweetpotato; white potato and tomato.

For each crop, information is given on: the specific soil, climatic and irrigation requirements; if insect pollinators or other specific cultural practices are required; the most common insect and disease problems on that crop in the Southern Region, and information concerning the problem, such as preliminary identification of the pest, the usual time during the growing season when pest problems become severe, economic threshold, beneficial insect or other I.P.M. practice information. If specific data on cover crops, or on the effect of animal wastes or other alternative fertilizer sources is available for a particular crop, it is included in the crop chapter.

Special topics, such as soil solarization, use of flame weeding and use of living mulches, are included in the crop chapters where information is available, but general

information on these practices or data from other crops is also included as a reference for interested growers who may want to experiment with these techniques. Also included are reference materials to provide further information on topics such as soil fertility, cover crops, insects, disease, nematodes and weeds which cannot be fully discussed in the document being prepared.

The entire volume will be indexed to allow more convenient access and footnoted to indicate sources of information. In addition a list of sustainable agriculture publications and organizations is provided.

OBJECTIVE 3:

The organization of the manual is discussed above. The project is now in the evaluation phase. Some material has been distributed for outside scientific evaluation, and suggestions are being incorporated. Beginning in January, 1993 discussions of crop chapters with groups of farmers who have used sustainable practices for a number of years will be held. Their input on soil fertility, crop rotations, and other whole-farm components will be integrated into the recommendations to the extent possible.

OBJECTIVES 4 & 5:

Hard Copy: plans are to have the material finalized for final editing by spring of 1994, with the manual ready for distribution by fall of 1994.

Project Duration: Two years (Extended to 3/31/94)

Funding: $37,000. Matching, $39,770.

LS91-33(51): REFERENCE MANUAL OF LISA RESOURCE MANAGEMENT STRATEGY BUDGETS FOR THE MID-SOUTH REGION

(Revised 4/93)

Major Participants:

University of Tennessee: Larry A. Johnson (Project Coordinator), Agricultural Economics & Resource Development, Agricultural Extension Service, Phone: (615) 974-7271; Clark D. Garland. **Note:** Project Coordinator is now employed by Tennessee Valley Authority Aricultural Institute, PO Box 1010, Muscle Shoals, AL, Phone: (205) 386-2785. Project will continue at TVA and is in process of transition.

University Representatives: Auburn University, University of Georgia, Mississippi State University.

Participating Extension Agents: Tennessee, Georgia, Alabama and Mississippi.

Farmer Participants:

Tennessee, Georgia, Alabama and Mississippi.

Overview

Conventional agriculture requires specialized, capital intensive systems that are dependent upon high levels of purchased inputs. Excessive use of many of these inputs can have detrimental effects upon the environment, raise food safety issues and often result in lower returns to farmers and increased risk levels. Environmental and food safety improvements can be made and farmers would gain financially from reduced cost levels associated with the incorporation of proven low-input farming methods.

Objective

The objective of this LISA proposal is to develop LISA-related Resource Management Strategy (RMS) budgets for selected agricultural enterprises and systems located in the mid-south region. The budgets would provide sound economic information on LISA management practices to farmers, Extension personnel, ASCS and SCS offices and other interested individuals and organizations.

Progress on Objective

Current emphasis has been placed upon development of enterprise and systems budgets for traditional crops. A total of 202 enterprise and systems budgets have been developed and represent a broad array of field crop, forage crop, livestock, fruit, vegetable, nursery and greenhouse crops. Included also are budgets for field and forage crops under various tillage systems including contour, contour strip, no tillage and limited tillage. Multi-crop rotations under various tillage systems with the addition of cover and legume crops have also been developed.

Environmental data were gathered keying in on soil erosion, pesticide runoff and leaching potential, excess nitrates and the use of fuel, water and other limited resources. All environmental and budgetary data has been entered into the SMART system database for farmer use.

In addition, a limited amount of economic analysis has been performed on representative farms comparing conventional versus sustainable systems both outside and within the government program. Preliminary analysis indicates that sustainable systems using crop rotations, cover crops, and legumes can be more profitable and less environmentally harmful. This holds true as long as the rotation scheme does not destroy base acres.

Project Duration: Two years

Funding: $50,000. Matching $50,000.

LS91-34(97): TOTAL RESOURCE BUDGETING OF LISA RELATED MANAGEMENT STRATEGIES

(Revised 4/93)

Major Participants:

Auburn University, AL: Jerry R. Crews (Project Coordinator), Assoc. Professor, Extension Economist-Farm Management, Phone: (205) 844-3506. Robert Goodman, Asst. Professor, Extension Economist-Resource Use; James L. Novac, Asst. Professor, Extension Economist-Risk Management. Agronomy and Soils Department: Don M. Ball, Professor, Extension Agronomist-Forages; John W. Everest, Assoc. Professor, Extension Weed Scientist; James E. Hairston, Assoc. Professor, Extension Water Quality Scientist; Paul Mask, Asst. Professor, Extension Agronomist-Crops; Charles C. Mitchell, Jr. Animal And Dairy Sciences Department: B.G. Ruffin, Assoc. Professor, Extension Animal Scientist. Entomology Department: Ronald H. Smith, Professor, Extension Entomologist.

Farmer Participants:

Producers/Cooperators: Jimmy Blythe, Lawrence County, AL; John Boutwell, Autauga County, AL; Gerald Croweley, Houston County, AL.

Overview

American Agriculture is an industry still in transition. Substitution of capital for labor may no longer be the answer to increased productivity. Higher yields alone may not be sufficient to increase production efficiency. Increased projection efficiency may no longer hold the key to short-run profits and long-run financial survival.

Farmers now are more aware of the marketing and financial aspects of their farm businesses. They are seeking ways to integrate financial, market, production and institutional risks into comprehensive, long-term risk management strategies. They are looking for ways to realize their individual comparative advantages in farming. They are seeking systems which will maintain, even enhance, their productive resource base on time. They are beginning to think in terms of long-run strategies for financial survival sustainability rather than one-time decisions for short-run profits.

Alternative technologies can be integrated into a common decision-making framework by reducing each decision to its potential impact on profitability, feasibility and its corresponding risk of loss or threat of survival. This approach (total resource budgeting) allows integration of physical and economic data from a variety of disciplines into a unified, comprehensive synthesis.

This approach and analytical tool can provide the basic foundation to help farmers make logical, economic choices among conventional and low-input technologies in developing more effective farm financial management strategies.

Objectives

(1) To help farmers make logical, economic choices among conventional and low-input enterprises and technologies in developing more effective farm financial management strategies.

(2) To develop enterprise budget information, including costs and returns and total resource use, that will support state and regional extension-research projects designed to develop and disseminate information pertaining to low-input, sustainable agriculture (LISA).

(3) To contribute to the program development and support of SMART-FRMS national project to provide farmers with a practical, usable decision support system needed to evaluate potential impacts of alternative enterprises and technologies on expected revenues, whole-farm risks and sustainability of their farming operations.

Progress on Objectives

An interdisciplinary team of extension specialists were assembled to provide input in the development of approximately 40 rotational and/or crop/livestock systems based on their feasibility and adoptability for Alabama and southern agriculture. Preliminary findings indicate a large degree of potential risk (production, environmental, financial) inherent to those systems evaluated. Final analysis will not be completed until late 1993.

Beginning with the final "field-testing" stages of the project, extension personnel have been trained using computer software and underlying methodologies. Forthcoming extension publications describing the study (and potential impact) will accompany area workshops for producers and others. Computer software support and documentation will also be made available to extension personnel to enhance producer adoption and analyses.

Project Duration: One year (Extended to 12/31/93)

Funding: $19,500. Matching, $36,648.

LS91-35(20): IMPROVED NITROGEN USE-EFFICIENCY IN COVER CROP BASED PRODUCTION SYSTEMS

(Revised 4/93)

Major Participants:

North Carolina State University: M.G. Wagger (Co-project coordinator), Raleigh, NC, Phone: (919) 737-2655; G.D. Hoyt (Co-project coordinator), Mountain Research Station, Fletcher, NC.

University of Georgia: W.L. Hargrove (Co-project Coordinator), Griffin, GA; M.L. Cabrera (Co-project Coordinator), Athens, GA.

Overview

Environmental concern regarding nitrate (NO_3) pollution of groundwater is a major problem facing agriculture in the 1990's. Winter annual cover crops, as a component of conservation production systems, can provide a means of utilizing residual or mineralized NO_3 in soils during non-crop periods and thereby reduce the amount of NO_3 leaching. The subsequent availability of N recovered by cover crops is also of interest when one considers the importance of resource-use efficiency in sustainable production systems. Unfortunately, this potential role of cover crops has not been adequately documented in field experiments.

The proposed research will be a multi-state and multi-disciplinary activity, utilizing field experiments and tracer techniques to achieve the stated objectives. Results from this research will help identify new low-input methods involving cover crops use while maintaining soil productivity and environmental quality. Efficient utilization of N will be enhanced by an improved understanding of the role cover crops can play in capturing residual fertilizer N and potential adjustment of N rate recommendations. Additionally, a relatively simple model describing N release from cover crop residues will enable further streamlining of summer crop N requirements.

Information transfer will be accomplished through presentation at state and national meetings, publication of scientific journal articles, extension literature, and field day activities.

Objectives

(1) Evaluate the potential of several cover crops to capture residual fertilizer N from a corn production system.

(2) Study the field and laboratory decomposition of cover crops for the purpose of developing a simulation model to describe N release from cover crops over a wide range of soil and climatic environments.

Progress on Objectives

Objective 1: In general, dry matter and N accumulation by crimson clover lagged behind the small grain cover crops (rye, wheat, and oat) from late fall to early spring at all locations of field trials. These field experiments are being evaluated a second year in newly-established areas.

Objective 2: Results of a preliminary study to test N release from decomposing cover crop residues suggest that loss of N via ammonia volatilization can be significant with a legume residue such as crimson clover. In addition, it seems necessary to measure N losses via

denitrification, which may be important during the early stages of decomposition, when high CO_2 emissions may cause partially anaerobic microsites.

Based on the above results, a long-term incubation study has been initiated to measure net N mineralization from crimson clover, rye, wheat, and oat. The data collected will be used to adjust a simulation model of N mineralization. Further studies to determine effects of temperature and water content on N mineralization from surface-applied residues are planned for the future.

Project Duration: Three years

Funding: $179,992. Matching, $261,922.

LS91-36(63): PEST MANAGEMENT AND ORCHARD FLOOR MANAGEMENT STRATEGIES TO REDUCE PESTICIDE AND NITROGEN INPUTS

(Revised 4/93)

Major Participants:

Oklahoma State University: Michael W. Smith (Project Coordinator), Research Horticulturist, Dept. of Hort. & L.A., Stillwater, OK 74078, Phone: (405) 744-6463. Raymond D. Eikenbary, Research Entomologist, Dept. of Entomology; Glenn C. Taylor, Extension Horticulturist, Dept. of Hort. & L.A.

USDA/ARS, Southeastern Fruit and Tree Nut Laboratory: W. Louis Tedders, Research Entomologist, Byron, GA 31008. Bruce W. Wood, Research Horticulturist; Michael T. Smith, Research Entomologist.

Noble Foundation: Gordon Barlow, Horticulturist, Ardmore, OK 73401. Dan Childs, Agricultural Economist; Scott Landgraf, Soil Scientist & Agronomist.

Farmer Participants:

Mike Spradling, Sand Springs, OK 74063; Emmette Vinson, Centerville, GA 31001.

Overview

The purpose of this study is to develop and test a pest management and orchard floor management system for use by pecan growers. The system utilizes winter legumes interplanted in the orchard to produce and manage native beneficial insect predators and parasites for early-season aphid control. The system also utilizes release of commercially available predators and parasites for mid- and late-season aphid control and control of lepidopterous pests, and the inoculation of soil hibernation sites with an insect pathogenic fungus for control

of pecan weevil. Using these bio-control techniques all pecan insect pests can be managed to achieve economic control. Legumes will be managed to supply the pecan nitrogen requirement. This management system could reduce pesticide use in pecan orchards by two-thirds and eliminate commercial nitrogen application.

Objectives

(1) Demonstrate the advantages of utilizing winter cover crops of legumes in commercial pecan orchards to produce beneficial insects for control of aphids and other pests on pecan trees during the spring.

(2) Test and evaluate the use of certain commercially available beneficial insects for control of aphids and lepidopterous pests of pecan trees and to evaluate the use of an insect pathogenic fungus for control of the pecan weevil.

(3) Evaluate selected legumes to reduce commercial nitrogen inputs for pecan production.

Progress on Objectives

Objective 1: Insect populations were monitored in pecan groves with legume cover crops in Oklahoma and Georgia. Pests monitored were black margined, yellow, black, pea, and blue alfalfa aphids; beneficial insects monitored included lady beetles (five species), green lacewings (two species), brown lacewings, nabids, assassin bugs (three species), syrphids and spiders. Weather during 1992 was uncharacteristic, with spring temperatures cooler than normal, and frequent rainfall occurring throughout the summer. These conditions suppressed insect populations; however, the data suggests that beneficials associated with legume ground covers reduced pecan pests.

Objective 2: Preliminary results of a study of *Trichogramma*, which is parasitic on pecan nut casebearer eggs, indicated that *Trichogramma* did not satisfactorily control pecan nut casebearer; however, the *Trichogramma* utilized were from a commercial source which had not been isolated from pecan lepidoptera. *Trichogramma* from shuckworm on pecan has now been isolated to be utilized in future tests. Also such factors as release sites, time of release, and release rates should be tested. Substantial improvement in casebearer control by *Trichogramma* may be made with additional research.

Objective 3: Crimson clover plus hairy vetch supplied the equivalent of 133 lbs. of nitrogen per acre at one site. Pecan leaf nitrogen values in the crimson clover/hairy vetch plots were 2.5%, which are within the normal nitrogen concentration range. Samples from the other site are currently being analyzed. These results suggest that crimson clover/hairy vetch ground covers may supply the total nitrogen requirement of pecan; however, additional data is needed to confirm these findings.

Project Duration: Three years

Funding: $150,000. Matching, $74,656.

LS91-37(120): LOW-INPUT CROP AND LIVESTOCK SYSTEMS FOR THE SOUTH-EASTERN UNITED STATES (See LS88-8.2)

LS91-38(53): DEVELOPING AND EXTENDING MINIMUM INPUT STRATEGIES FOR WEED CONTROL IN AGRONOMIC AND HORTICULTURAL CROPS (See LS88-11.2)

LS91-39(27): USE OF POULTRY LITTER AS A SOIL AMENDMENT IN SOUTHERN ROW CROP AGRICULTURE: A FEASIBILITY STUDY BASED ON AGRONOMIC, ENVIRONMENTAL, AND ECONOMIC FACTORS (This project is continued as ACE project AS93-10)

(Revised 4/93)

Major Participants:

University of Arkansas: David M. Miller (Project Coordinator), Research Soil Chemist, Fayetteville, AR 72701, Phone: (501) 575-5747.

Auburn University: C. Wesley Wood, Research Agronomist-Soil Fertility, AL 36879-5412.

County Extension Agents: N. Slaton, Area Rice Specialist and Coordinator, Rice Research Verification Trial Program, Stuttgart, AR; R. Chlapecka, Staff Chairman, Arkansas CES, Jackson County, AR; C. Hoomes, Blount County, AL; G. Hodges, Cullman County, AL; C. O'Daniel, Dekalb County, AL; R. Hughes, Lauderdale County, AL; F. Wood, Marshall County, AL.

Farmer Participants:

T. Lewis, Jackson County, AR; H. Whitley, Horton, Blount County, AL; J. Yancey, Baileyton, Cullman County, AL; D. Johnson, Fyffee, Dekalb County, AL; D. Newbern, Rogersville, Lauderdale County, AL; K. Martin, Albertville, Marshall County, AL.

Overview

Poultry Litter (PL) is a valuable, abundant, but under-utilized agronomic resource throughout much of the southeastern US. Instead of being used to enhance the productivity of the region's agriculturally important soils, most PL is disposed of on conveniently located pastureland, where frequent heavy applications result in the addition of excessive quantities of nutrients which now threaten local water supplies. Both water quality in the poultry

producing regions and prospects for reduced dependence on inorganic fertilizers and sustained agricultural productivity in the row crop regions would improve if PL were to be used as a soil amendment in southeastern row crop agriculture. The economic feasibility of such a practice has never been examined because the necessary data on crop and environmental responses to this type of PL usage are not available.

The proposed study will determine how applications of PL affect crop yields and composition, soil chemical and biological properties, and water quality, and use this data to conduct economic analyses of PL usage in southeastern row crop agriculture. Cotton, corn, rice, soybeans and bermuda grass will be amended with either inorganic fertilizer or PL in replicated experiments conducted at eleven sites. Emphasis will be placed on developing profitable, environmentally benign PL management strategies that reduce the need for chemical inputs and improve the long-term productivity of the soil.

Objectives

The goal of the proposed research is to determine under what conditions producers of row crops in the Southern Region can profitably use poultry litter (PL) as a soil amendment. In order to accomplish this, we will:

(1) Quantify both the short-term and long-term agronomic value of PL.

(2) Document the environmental consequences of land application of PL in the row crop regions.

(3) Using the agronomic data, estimate the farm-level derived demand for PL.

This research is consistent with the goals of the LISA program in that it attempts to evaluate and demonstrate a farming practice that may reduce chemical inputs, alleviate a serious agricultural waste disposal problem, and improve long-term productivity of the soil without adversely impacting production efficiency or the environment.

Progress on Objectives

Short-term effects:

In Alabama, fields where poultry litter was applied to cotton, corn, soybeans, bermudagrass, and winter wheat outperformed fields where commercial was used in most cases.

In Arkansas, replicated experiments using cotton, rice, and soybean showed significant increases in yield with the use of fresh litter or composted litter as compared with conventionally treated controls. There appears to be no difference in the overall effectiveness of fresh and composted poultry litter.

Long-term effects and environmental consequences:

Long-term land application of broiler litter at disposal rates typically used in Sand Mountain region of Alabama are creating a potential for harmful environmental effects in the region the results suggest that much of the litter generated in this intense poultry producing region should be transported to areas of intense row crop production, such as the adjacent Tennessee Valley region.

Farm-level demand for poultry litter:

Results of the economic analysis suggest that there is a significant demand for poultry litter and poultry litter compost as a soil amendment. In the Mississippi Delta region of Arkansas, use of fresh poultry litter can be profitable for rice, irrigated cotton and irrigated soybeans when litter can be obtained at a price of $45 per ton or less.

Project Duration: Two years (extended to March 31, 1994)

Funding: $100,000 in 1991; $100,000 in 1992. Matching, $68,909 in 1991; $68,909 in 1992.

LS91-40(44): UTILIZATION OF WINTER LEGUME COVER CROPS FOR PEST AND FERTILITY MANAGEMENT IN COTTON

Major Participants:

University of Arkansas: Craig S. Rothrock (Project Coordinator), Plant Pathology Dept., Fayetteville, AR 72701, Phone: (501) 575-6687. R.E. Frans, Weed Scientist, Agronomy Dept.; T.J. Kring, Entomology Dept.; L.D. Parsch, Agric. Econ. And Rural Soc. Dept.; H.D. Scott, Soil Physicist, Agronomy Dept.

University of Arkansas: T.L. Kirkpatick, Plant Pathologist; J.J. Phillips, Agronomist, Southwest Arkansas Research and Extension Center, Hope, AR 71801.

University of Arkansas: J.S. McConnell, Agronomist, Southeast Arkansas Research and Extension Center, Monticello, AR 71655.

Clemson University: J.D. Mueller, Plant Pathologist; P.M. Porter, Agronomist; M.J. Sullivan, Entomologist, Edisto Research and Education Center, Blackville, SC 29817.

Louisiana State University: P.D. Colyer, Plant Pathologist, Red River Research Station, Bossier City, LA 71113.

Farmer Participants:

McCoy Brothers' Farm, Route 11, Box 1, Oswego, SC 29150; Matteson Farms, Hwy 108W, Foreman, AR 71836; Brent Brothers' Farm, Route 2, Box 212, Lewisville, AR 91845.

Overview

Cotton is an intensively managed crop, and its profitability is determined in large part by pesticide use and pest damage. The overall thrust of this project is the evaluation of a low-input legume cover crop-cotton production system to reduce environmental risks and improve profitability.

Objectives

(1) Evaluation of the impact of legume cover crop-cotton rotations on management of insects, diseases, nematodes, and weeds in cotton by conducting field experiments at locations where soil and environmental conditions and pest pressures are representative of cotton production in the southern United States. The cover crop treatments, hairy vetch and winter fallow, will be compared in new and long-term established studies. Conventional and minimum-tillage treatments will be compared in all regions. Additional treatments will be included at selected sites to refine management strategies and increase understanding of the agroecosystem.

(2) Quantify changes in soil properties and crop growth as a result of cover crop or tillage treatment. In addition, environmental and health risks due to leaching of nitrates will be determined.

(3) Determine profitability of legume cover crops for cotton production, as a result of reduced fertilizer, pesticide, and tillage inputs, through economic analyses.

(4) Results of the research and economic analyses will be disseminated through field days and extension activities.

Progress on Objectives

The data for 1992 indicate fall-planted hairy vetch is generally pest neutral for insects, weeds, soilborne pathogens, and nematodes compared with winter fallow. The hairy vetch cover crop reduced black root rot of cotton, caused by Thielaviopsis basicola, compared to the winter fallow treatment. Root-knot nematodes increased under the vetch cover crop, however. Future research will be needed to confirm the pest neutral and positive effects demonstrated in 1992.

Project Duration: Two years

Funding: $100,000 in 1991; $100,000 in 1992. Matching, $134,498 in 1991; $104,468 in 1992.

1993 Continuation

LS91-40.1: UTILIZATION OF WINTER LEGUME COVER CROPS FOR PEST AND FERTILITY MANAGEMENT IN COTTON (Continuation of project LS91-40(44).)

Major Participants:

University of Arkansas: C. S. Rothrock (Project Coordinator), Plant Pathology Department, Fayetteville, AR 72701, Phone: (501) 575-6687. R. E. Frans, Weed Scientist, Agronomy Department. T. J. Kring, Entomology Department. L. D. Parsch, Agricultural Economics and Rural Sociology Department. T. L. Kirkpatick, Research/Extension Plant Pathologist, and J. M. Phillips, Research/Extension Agronomist, Southwest Arkansas Research and Extension Center, Hope, AR 71801. J. S. McConnell, Research/Extension Agronomist, Southeast Arkansas Research and Extension Center, Monticello, AR 71655. T. C. Keisling, Research/Extension Soil Scientist, Soil Testing and Research Laboratory, Marianna, AR 72360.

Clemson University: J. D. Mueller, Research Plant Pathologist; P. M. Porter, Research/Extension Agronomist; M. J. Sullivan, Research Entomologist, Edisto Research and Education Center, Blackville, SC 29817.

Louisiana State University: P. D. Colyer, Research Plant Pathologist, Red River Research Station, Bossier City, LA 71113.

Farmer Participants:

George C. Matteson, Matteson Farms, Hwy 108W, Foreman, AR 71836. Clarence Brent, Brent Brothers' Farm, Route 2, Box 212, Lewisville, AR 91845. Charles Brown, Kirby Brown & Sons Farm, 705 Railroad Avenue, Springfield, SC 29146.

Overview

The focus of this ongoing project is the evaluation of an integrated crop management system, which utilizes winter legume cover crops and reduced tillage practices to suppress cotton pests and minimize production costs and environmental risks. The aspects of sustainable agriculture addressed include decreased dependence on fossil fuels, fertilizers, and pesticides, and enhanced crop productivity through soil organic matter maintenance, crop diversification, and decreased soil erosion.

Objectives

(1) To evaluate the effects of legume cover crop-cotton cropping sequences on the ecology and management of insects, nematodes, diseases, and weeds in cotton.

(2) To quantify the environmental and ecological benefits of legume cover crops on soil physical, chemical, and microbiological properties and of reduced pesticide and fertilizer usage.

(3) To determine profitability of legume cover crops in cotton production systems through reduced nutrient, pesticide, and tillage inputs.

Project Duration: One year

Funding: $104,000. Matching, $89,280.

LS91-41(43): UNIFORM SPRAY DEPOSITS FOR REDUCED PESTICIDE USE IN WEED AND INSECT CONTROL OPERATIONS

(Revised 4/93)

Major Participants:

Mississippi State University: David R. Shaw (Project Coordinator), Weed Science, P.O. Drawer PG, Mississippi State, MS 39762, Phone: (601) 325-2598. David B. Smith, Agricultural Engineer; Randall G. Luttrel, Entomologist.

Extension Participants: Perry Kimbrough, Clay County Extension Agent.

Farmer Participant:

Charles Wade, Wade Brothers Farms.

Overview

Today's pesticide dose (or rate) recommendations for row crops are nearly always in excess of the doses which have been shown to be effective when used and applied properly. The recommendations reflect a "measure of insurance" against no or poor sprayer calibration, adverse weather, and poor deposit uniformity obtained with the majority of the application equipment in current use. Past research has addressed a wide variety of factors involved in erratic pest control, including environment and pest species and size. However, little research has been conducted to evaluate potential influences of pesticide deposit variation on pest control; therefore, the proposed research addresses this question.

An electronically controlled field sprayer will be used to create three levels of variation among deposits on common cocklebur and cotton canopies. High Performance Liquid Chromatography (HPLC) and Gas Chromatography (GC) equipment will be used to quantify the magnitudes of herbicide and insecticide deposits on common cocklebur and cotton, respectively. Deposit variation data will then be compared with actual weed and insect control data to determine the effects of deposit variation on pest control. Results from the first year's research will also be used in the second year at the farm level to demonstrate the impact of pesticide deposit variation on weed and insect control, and the potential for economic and environmental benefits through reductions in pesticide application rates. These levels of variation will be used at two or more pesticide rates in order to demonstrate the potential rate reductions possible through more uniform pesticide applications.

Objectives

(1) Improve weed control and reduce environmental pesticide impact by reducing the variation of on-target herbicide deposits.

(2) Improve cotton insect control and reduce environmental pesticide impact by determining the effect of insecticide deposit variation on insect control.

Results

Labeled pesticide rates typically are higher than what are needed to adequately control pests. This provides a margin of error for poor application techniques, larger- than-optimum pest size, and poor environmental conditions. However, under appropriate conditions, producers may be able to save money and reduce the introduction of pesticides into the environment by improving sprayer efficiency and reducing pesticide rates. Common cocklebur control at a high level of spray deposit variation required 50% more acifluorfen than at a low level of deposit variation.

Project Duration: One year

Funding: $43,500. Matching $46,830.

LS91-42(1): INTENSIVE SHORT COURSE ON GRANT PREPARATION FOR FUTURE APPLICANTS TO THE LISA COMPETITIVE GRANTS PROGRAM

(Revised 4/93)

Major Participants:

University of Florida: Carl S. Barfield, Department of Entomology & Nematology, 3103 McCarty Hall, Gainesville, FL 32611, Phone: (904) 392-1901.

Farmer Participants:

This short course is planned for farmers, farmer groups, Soil Conservation Service personnel and others whose normal jobs do not encompass the writing of competitive grant proposals.

Overview

During the FY 90 LISA technical review process, much discussion focused on the quality of proposals which were submitted. While the majority met the intent of the LISA program, it was clear that many proposal authors lacked adequate experience with the details of technical writing -- especially as related to the preparation of competitive grants. Such was not unexpected, as several proposals originated from farmers, farmer collectives, personnel

with the Soil Conservation Service, etc. Following the review of FY 90 LISA proposals, discussion was held on the possibility of offering an intensive short course on technical proposal preparation as a vehicle for increasing the quality of LISA proposals submitted in future years. Such a course would NOT be for university-based faculty, whose needs to acquire extramural funding **should** have already provided experience in competitive grant writing. Rather, the course would be aimed at farmers, farmer groups, Soil Conservation Service personnel and others whose normal jobs do not encompass the writing of competitive grant proposals. This project proposes a course in grant writing and stems directly from post-review discussions following the FY 90 LISA review process. The course will be held the second week in January, 1992.

Objectives

(1) Hold a five-day intensive training short course on Grantwriting on the University of Florida campus, Gainesville, Florida.

(2) Target individual farmers, representatives of farmer groups, and any other LISA-relevant persons (1-2 per state from the LISA Southern Region) and pay their travel, per diem and course costs.

(3) Enable participants to emerge from the five-day course with a first-draft LISA proposal which they can revise and actually submit to the LISA program at the proximate submission date.

Narrative

This course offered the potential of elevating non-university persons to a more competitive level with university faculty in the area of competitive grant writing. It offered a vehicle for making farmers themselves (a stated objective of the SARE/ACE effort) more competitive for SARE/ACE funds through submission of science-based competitive grant proposals.

The course consisted of five days (8-9 hrs/day) of experiential training. The focus was solely on the intent, structure, format and details of preparation of SARE/ACE competitive grants. Past experience demanded focus on development of an ability to state proposal objectives explicitly and then to match experimental design and proposed analyses to each objective (on an objective-by-objective basis). Participants wrote an explicit statement of their proposal objectives, then drafted rationale and justification sections. Experimental design and timetable sections were then drafted along with a budget. The result of intensive work by the participants resulted in each arriving at a fairly good draft proposal. The course also resulted in an increased ability of the participants to have a relevant proposal drafting conversation with university counterparts.

Project Duration: One year

Funding: $39,000 in 1991. Matching, $10,608.

Organization	Sustainable Agri. Funds	Matching Funds
University of Florida, Gainesville	$39,000	$10,608
Totals	$39,000	$10,608

LS91-43(40): COVER CROPS FOR CLEAN WATER: A NATIONAL CONFERENCE ON THE ROLE OF COVER CROPS IN IMPROVING WATER QUALITY

(Revised 4/93)

Major Participants:

University of Georgia: W.L. Hargrove (Project Co-Coordinator), Agronomy Department, Griffin, GA 30223-1797.

University of Tennessee: D.D. Tyler, West Tennessee Agricultural Experiment Station, Jackson, TN.

Overview

Cover crops, which are used in many agricultural production systems to protect soil and conserve water between cropping cycles, have many implications for water quality management, including reduced water run-off, reduced soil erosion, reduced agrichemicals lost in runoff, and reduced nitrate available for leaching to groundwater. These implications and how cover crops can be used effectively to achieve water quality management goals were discussed at a conference April 9-11, 1991, in Jackson, Tennessee. The conference was sponsored in part by the Soil and Water Conservation Society in cooperation with a number of agricultural and conservation agencies and organizations.

The program consisted of two-and-one-half-days of presentations. An invited speaker introduced each segment of the program with a state-of-the-art presentation. Oral presentations of volunteered papers followed each of these overview presentations. Additional volunteered presentations were made via 36 poster papers.

Objective

The objective was to collect and disseminate new and old information on cover crops and their role in water quality.

Narrative

Ten subject areas were addressed during the course of the conference:

- Expectations of Cover Crops in Sustainable Agriculture
- Effect of Cover Crops on Water Runoff and Soil Erosion
- Development and Evaluation of Cover Crop Germplasm
- Role of Cover Crops:
    - In Surface Water Quality
    - In Groundwater Quality
    - In Maintaining Soil Productivity
    - In Nutrient Cycling
    - In Weed Management
    - In Integrated Crop Production Systems
    - In Integrated Animal Production Systems

Invited speakers prepared "white papers" on each topic. In addition, the volunteer presenters were asked to provide extended summaries of their presentations. The proceedings of the conference, including the white papers and the extended summaries, has been published and was made available to conference participants at the outset of the conference. A conference proceedings was published by the Soil and Water Conservation Society, 7515 N.E. Ankeny Road, Ankeny, Iowa 50021-9764.

A half-day field tour was also conducted to see cover crop research at the Milan Experiment Station. This is a well-known station that hosts an annual no-till field day with 4,000+ attendees.

Project Duration: One year

Funding: $8,000 in 1991. Matching, $30,995.

Organization	Sustainable Agri. Funds	Matching Funds
University of Georgia	$8,000	--
Conference Registration Charges	--	$12,895
Tennessee Valley Authority	--	5,000
USDA/SCS	--	5,000
USDA/ARS	--	2,000
Pioneer Hybrid International	--	1,500
American Soc. of Agronomy	--	1,000
Crop Science Soc. of America	--	1,000
Soil Science Soc. of America	--	1,000
Monsanto	--	500
ICI Americas	--	500
Land Improvement Contractors of America	--	400
Truax Co., Inc.	--	200
Totals	$8,000	$30,995

LS91-44(189): SMART -- SUSTAINING AND MANAGING AGRICULTURAL RESOURCES FOR TOMORROW: TRAINING FOR THE SOUTHERN REGION

Major Participants:

University of Missouri: John Ikerd (Project Coordinator), Economist, Center for Sustainable Agriculture, Columbia, MO 65211, Phone: (314) 882-3545.

University of Minnesota: R.O. Hawkins, Agricultural Economist, Center for Farm Financial Management, St. Paul, MN 55108, Phone: (612) 625-1964. Richard Levins, Agricultural Economist, Dept. of Agricultural and Resource Economics.

Iowa State University: Mike Duffy, Economist, Dept. of Economics, Ames, IA 50011, Phone: (515) 294-6740.

Utah State University: Larry Bond, Agricultural Economist, Agricultural Economics Dept., Logan, UT 84322, Phone: (801) 750-2310.

University of Florida: Timothy Hewitt, Extension Specialist, Dept. of Food & Resource Economics, Gainesville, FL 32611, Phone: (904) 392-1826.

University of Delaware: Don Tilmon, Agricultural Economist, Dept. of Food and Resource Economics, Newark, DE 19717, Phone: (302) 451-2512

Cooperators: (On Advisory Committee)

Iowa State University: Steve Padgitt, Sociologist, Ames, IA.

Rutgers University: Zane Helsel, Agronomist, New Brunswick, NJ.

Clemson University: Jerry Lambert, Information Specialist, Clemson, SC.

Winrock International: Frank Baker, Animal Scientist, Morrilton, AR.

USDA/Extension Service: Buel Lanpher, Farm Management Specialist; Dixon Hubbard, Administrative Advisor; John Moorehead, Administrative Advisor, Univ. Ext., Missouri.

Farmer Participants: (On Advisory Committee)

Gordon Watkins, Arkansas; Don and Delores Easdale, Missouri.

Overview

US farmers are faced with growing environmental concerns and rising costs associated with highly specialized farming operations. They are searching for farming systems that are ecologically and economically sustainable. Such farmers are searching for ways to reduce their dependence on external purchased inputs while maintaining their productivity and profits through more intensive management of their internal resources.

A lower-input sustainable agriculture, microcomputer-based, farm decision support system (SMART-FRMS) has been developed through a nationally funded project to address the farm planning and decision making objectives listed below. The project proposed here will regionalize training and follow-up implementation of SMART-FRMS at the farm level.

Objectives

(1) Assist farmers to develop sustainable farming systems by considering water quality, soil loss and financial impacts and risks as multiple objectives in a whole-farm, multi-year approach to farm planning.

(2) Provide regionalized, site specific, individualized decision support to farmers in developing plans for transitions from conventional to lower-input farming systems.

(3) Make the full range of existing LISA data available to farmers in a readily usable form by disseminating information about technologies, methods and practices which support sustainable farming systems.

Narrative

Farm planning and decision making oriented toward the goal of sustainability requires that farmers deal with cropping rotations rather than individual enterprises and with whole-farm systems rather than individual farming practices or methods. The objective of such planning is to optimize management of the farm's physical, biological and economic resources over time rather than maximize or minimize any single farm objective at any given point in time.

A resource management strategy (RMS) for a cropping system consists of a crop sequence or rotation, an irrigation system (if any), a tillage system, a fertility system and a pest management system. An RMS planning budget reflects the resource and input requirements, input costs, expected production, expected returns, potential conservation impacts and potential environmental impacts of individual crops as components of a cropping system. An RMS budget contains all non-site specific information needed to calculate expected soil loss, water quality risks, resource use, gross revenue margin and revenue risks.

The RMS budget data bases used in SMART-FRMS (Sustaining and Managing Agricultural Resources for Tomorrow -- Farm Decision Support System) will contain budgets for cropping and livestock systems deemed appropriate for the geographic region of application. These data bases will be constructed by extension specialists familiar with local farming systems. Development of resource and environmental (R & E) budget components will be facilitated by a budgeting program, BUDGETOR, developed as a part of the SMART-FRMS project.

Each cropping system will be budgeted for up to four alternative input systems. An input system will reflect a specific fertility and pest management system. Most systems would be budgeted with unrestricted input, reduced input, and low input RMS alternatives.

Unrestricted RMS budgets will reflect use of typical fertilizer and pesticide inputs for a particular cropping system for use on fields with no significant fertilizer or pesticide leaching or runoff risk potential. Reduced input RMS budgets will reflect some lower level of inputs suggested for fields with significant nutrient or pesticide risk potential. Split applications and banding of fertilizers and pesticides might be a logical reduced input system, for example. Low input systems should reflect minimum levels of external inputs that specialists deem feasible for commercial production on fields with high nutrient loading or pesticide risks.

Each cropping system will also be budgeted for alternative tillage levels. Tillage options will range from unrestricted tillage to minimum tillage. Unrestricted tillage would be the suggested system for fields without erosion problems with minimum tillage suggested for

highly erodible fields. Each tillage system should be matched with an appropriate complement of inputs. Consequently, some systems may have no low input, minimum tillage RMS, if such a combination of tillage and inputs is not considered feasible for a given cropping system.

The whole-farm planning program, PLANETOR, is a microcomputer-based decision support program which allows farmers to evaluate the potential impact of using various cropping systems or RMSs on their specific farms. PLANETOR is a field- based system. It allows the farmer to plan his or her farm field-by-field, year-by-year and to assess the RMS implications for each field, each year for the whole farming system, including livestock as well as crops.

All site-specific information and associated yield and environmental impact estimates are calculated within the whole-farm planning program. Thus, the whole-farm planning process begins with a field-by-field inventory of the land or soil resources of the farm. Much of the information related to soil erosion and environmental vulnerability can be derived from the Soil Conservation Service (SCS) data base of soil types. Soil texture, pesticide leachability, pesticide surface loss potential, average slope and slope length and yield capability classes are identified in the SCS data base of US soils; however, the farmer will be asked to verify yield potentials, soil characteristics and environmental impact estimates in the planning process. Estimates of soil loss, water quality risks from pesticides and fertilizers, and input toxicity will be evaluated for cropping systems rather than for individual crops.

Financial and resource implications of alternative systems will be evaluated for the whole-farm system for each year in the planning period. Acreage of each crop, pastures, set-aside or conservation reserve, expected revenues, input costs, gross margins, revenue risks, corn equivalents produced and needed, hay equivalents produced and needed, and non-renewable energy use will be summarized for each year.

The ecological vulnerability of each field will be identified by color-highlighted codes for high, medium and low levels of vulnerability to soil loss, pesticide leaching and runoff. Each cropping system and RMS likewise will be color-coded with respect to its potential for soil loss, water quality and pesticide toxicity risks. These two sets of codes, one for the field and the other for the RMS, will be combined to yield a similar color-coded set of implications for using a given RMS on a given field.

Each combination of field and RMS will have a color-coded indicator of soil loss, pesticide and nitrogen water quality risk, and input toxicity. A set of "red R"s for a given RMS on a given field, for example, would indicate severe ecological problems. Such problems would be associated with using a particular RMS on a particular field. The same RMS might be okay on another field but a different RMS might be indicated for this particular field.

A similar approach will be used in the financial risk and resource sections of the program. An unacceptable income level for a given year would be color-coded with a red "R" or some similar sign. The farmer might first consider shifting rotations to get more high income crops in a given year, if the problem occurred only for one or two years; however, if

the problem occurs for several years, he or she may consider some more intensive RMSs that will generate more income in more years.

Inconsistencies between labor needed and labor availability would be flagged, indicating a need for better mixing of high and low labor crops or spring-fall and winter-summer labor crops by shifting rotations. If shifting rotations won't work, the farmer may be advised to change to lower labor RMSs or to hire labor during peak need periods if feasible. Feed needs and production would be handled in a similar manner. A red light on risk might suggest adding diversity through selection of alternative cropping systems, adding livestock to the system or possibly considering off-farm employment for income stability.

The Center for Farm Financial Management (CFFM) in Minnesota became involved with the project in a programming capacity but became full partners with the task force in final stages of overall program development. The CFFM has accepted responsibility for future program development, software maintenance and training. The national task force will work under the leadership of the CFFM over the next year to carry out and assist with orientation and fieldtesting.

The SMART-FRMS system was introduced at a national Sustainable Agriculture workshop for ES, SCS and other public and private farm-level advisors in the summer of 1990. The regional orientation sessions will be much more intensive and are expected to leave farm advisors prepared to begin direct work with farmers in planning for 1991 crops and developing tentative plans for the following six years.

Specific proposed activities include:

(1) Fieldtesting of SMART-FRMS with farmers in specific regions -- completed by March 1991.

(2) Regional training of farm advisors, up to 45 participants per region -- completed by March 1991.

(3) Follow-up consultation with farm advisors during 1991.

(4) Further fieldtesting, to be conducted in 1991 with follow-up in 1991-92.

Eighteen states have agreed to develop prototype Resource Management Strategy (RMS) Budgets to support the SMART-FRMS program; one region has funded a comprehensive RMS budget project and another has set aside a portion of LISA funds for budget development in 1991. Continuing support and development of the project has been funded through USDA/ES for cooperation of the national task force with the Center for Financial Management during the fieldtesting phase.

This program addresses the legislative mandate to make LISA-related research results readily available to farmers in easily usable form. The full range of existing and future research results and information can be reflected in resource management strategy budgets made readily usable by farmers through the PLANETOR program. For example, ecologic and

economic impacts of cover crops, intercropping, relay cropping, etc., in various rotations can be reflected in alternative RMS budgets. Uses of legumes and livestock manure for fertilizers as well as alternative systems of fertilizer application can be included among the RMS alternatives to be considered.

Impacts of alternative tillage systems and residue management programs on potential soil loss will be an integral part of the budgeting process. Alternative weed, insect and other pest control systems, including specific pesticide uses and their potential human and water quality risks, will be reflected directly in the environmental components of each RMS budget.

The whole-farm planning process allows farmers to synthesize profitable and sustainable farming systems by integrating relevant RMSs with their particular set of land, labor, machinery and management resources. They can select RMSs that are well-suited for their soils, climate and location-specific pest problems. They can integrate systems of livestock and crop RMSs that tighten or complete nutrient cycles, facilitate energy flows and enhance the ecologic and economic viability of their farming systems.

Farmers using the whole-farm planner can evaluate potential impacts of using various levels and types of nitrogen fertilizer on specific fields. They can match tillage systems and soil conserving practices with specific slope and soil characteristics of fields to reduce erosion. They can assess risks through evaluation of diversification effects of alternative farming systems and develop systems that are resistant, resilient and regenerative.

SMART-FRMS will not result in a recipe for success. It is just a tool to facilitate farm planning and management. A farmer who chooses an alternative to his or her current system will be advised to gather as much additional information as is available before adopting a new farming enterprise or practice. He or she will be strongly encouraged to talk with other farmers who have experience with the practice under consideration. Farmers will be encouraged to visit other farms where the practice is used before they change their own operation. They will be advised to work into any new system slowly so they can learn as they go.

SMART-FRMS will not ensure a more profitable or sustainable farming system. However, it will allow farmers to evaluate the potential impact of alternative LISA technologies and strategies within the context of their particular farming situation without doing the necessary research and testing on their own.

Project Duration: One year (extended to March 31, 1994)

Funding: $12,500. Matching, $20,000.

LS92-45: USE OF ORGANIC NITROGEN SOURCES FOR SWEETPOTATOES: PRODUCTION POTENTIAL AND ECONOMIC FEASIBILITY

Major Participants:

North Carolina State University: Wanda W. Collins (Project Coordinator), Vegetable Breeder, 210 Kilgore Hall, Department of Horticultural Science, Box 7609, Raleigh, NC 27695-7609, Phone: (919) 515-3167. D. S. Sanders, Department of Horticultural Science, Extension, Vegetable Production Systems; Jonathan Schultheis, Horticulture: Extension, Sweetpotatoes; David Monks, Horticulture: Extension, Vegetables, Weed Management. Edmund Estes, Department of Agriculture and Resource Economics, Extension, Farm Management and Marketing; Mary Barbercheck, Department of Entomology, Research, Soil Insects. Greg Hoyt, Mountain Horticultural Crops Research Station, Department of Soil Science, Research Alternative Crop Production Systems, Fletcher, NC.

Tuskegee University: Conrad K. Bonsi, George Washington Carver Agricultural Experiment Station, Tuskegee Institute, Alabama, Agricultural Science, Crop Protection.

North Carolina Coalition of Farm and Rural Families: Tony Alexander, Marketing Specialist, Durham, NC.

South Macon County Cooperative, P.O.Box 1186, Tuskegee, AL 36088.

Farmer Participants:

Kendall Hill, Tull Hill Farms, Kinston, NC and Ralph Batchelor, Route 3, Nashville, NC.

Objectives

(1) Evaluate yield, quality, and nitrogen cycling in sweetpotaotes using crimson clover as an organic source of nitrogen in different soil types in the Southeast.

(2) Evaluate the effect of crimson clover as an organic N source on nitrogen use efficiency (NUE) of different sweetpotato genotypes (including the effect of time of N availability relative to vine growth, storage root initiation and storage root bulking of individual genotypes) to determine potential for selecting for NUE.

(3) Evaluate the effect of crimson clover as an organic N source on sweetpotato and corn yield and quality (including observational data on disease, insect and weed problems) in a two-year rotation cycle when replacing all or part of the N applied from inorganic sources in the two-year cycle.

(4) Determine the economic feasibility of using crimson clover as an organic source of nitrogen for sweetpotato alone and in a two-year rotation cycle with corn.

Progress on Objectives

Project activities were initiated in the summer of 1992 with an extensive pot culture study of sweetpotatoes designed to determine how nitrogen affects the growth of sweetpotato. In the fall, crimson clover cover crops were planted in six locations in two states, as the first step in the studies which will provide the bulk of this project data.

Project Duration: Two years and 7.5 months then becomes AS92-6 under ACE Program for 4.5 months. Total three years.

Funding: $105,000 SARE Funds; $15,000 ACE funds; total, $120,000. Matching, $44,380 for SARE; $6,340 for ACE; total, $50,720.

LS92-46: DEVELOPMENT OF CROPPING SYSTEMS FOR NEMATODE MANAGEMENT ON AGRONOMIC AND HORTICULTURAL CROPS

Major Participants:

Coordinators: Researchers:

University of Florida: D. W. Dickson (Project Coordinator), Researcher, Nematologist, Entomology and Nematology Department, Bldg 970, Hull Road, 0740-IFAS, Gainesville, FL 32611-0740, Phone: (904) 393-1901 x135; R. McSorley, Researcher, Nematologist, Department of Entomology and Nematology; and

Auburn University: R. Rodriguez-Kabana, Nematologist, Department of Plant Pathology, Auburn, Alabama 36849. Drs. Dickson, McSorley and Rodriguez-Kabana will provide overall coordination of the project.

Participant: Researcher: University of Florida: G. J. Hochmuth, Researcher, Horticulturist, Vegetable Crops Department will monitor nitrogen mineralization among the different crops and provide technical advice on growing the horticultural crops.

Extension Specialists:

T. D. Hewitt, Economist, North Florida Research and Education Center, Marianna, FL 32446, will provide input into the economic analyses of the short-term and long-term cropping systems for nematode management.

R. A. Dunn, Nematologist (Agronomic Crops), Department of Entomology and Nematology, University of Florida, Gainesville, FL 32611-0740; R. C. Hochmuth, Vegetable Extension Specialist, Agricultural Research and Education Center, Live Oak, FL

32060; and W. S. Gazaway, Extension Plant Pathologist and Nematologists, Department of Plant Pathology, Auburn University, Auburn, Alabama 36849, will coordinate disseminating extension information so that useful cropping systems can be quickly adopted in fields infested with root-knot nematodes. At the conclusion of the demonstration (3 years), a regional meeting will be coordinated by the extension specialists in Atlanta, Georgia at which the results and resource materials will be provided. Extension specialists and key producers will be invited from neighboring states that would benefit from the materials.

Farmer Participants: Woodroe Fugate and Sons, Williston, Florida; and John Gottler, Elberta, Alabama, producers have direct involvement in the design and implementation of this program. Farmer involvement will also include on-farm replicated experimental plots in both Alabama and Florida.

Overview

Recent data indicate that several tropical crops offer root-knot nematode control after only one season of growth. This offers an exciting possibility for nematode management because it provides an environmentally sound and economical method of nematode control, particularly for small-scale vegetable producers. But the same principles are also applicable to all sizes of farms. We propose to evaluate several tropical crops (short term) and some improved forages (long term) for managing nematodes in the southeastern U. S. production region. In this region root-knot nematodes are major limiting factors in crop production. Specific treatments include castor, velvetbean, sesame, American jointvetch, partridge pea, sorghum sudangrass, root-knot resistant soybean cvs., cotton rhizoma peanut, and improved bahiagrass. Rye will be planted as a winter cover crop across all crops, plowed under, and followed by squash, peanut, cotton, or soybean. Data collected will be subjected to statistical analyses and the results prepared for publishing in an array of extension sources. At the conclusion of the evaluations a regional meeting will be scheduled in Atlanta, Georgia, at which the results will be provided to extension specialists, producers, and other interested parties.

Objectives

Our goal is to demonstrate the effectiveness and economic benefits of selected cropping systems for low-input, sustainable management of root-knot nematodes.

Specific objectives:

1. Develop and demonstrate the usefulness of selected tropical crops (short term) and forage crops (long term) in suppressing population densities of root-knot nematodes below damage levels.

2. Provide information on crop yields, production costs, pesticide use, net returns, and financial risks due to adoption of these alternative crops.

3. Determine the biomass added to the soil by each crop and the nitrogen mineralization following each crop.

4. Demonstrate and test models of seasonal nematode multiplication on the alternative crops.

Project Duration: Three years

Funding: $155,000 Matching, $184,350.

LS92-47: FARM SCALE EVALUATION OF ALTERNATIVE COTTON PRODUCTION SYSTEMS

Major Participants:

Texas A & M University: William M. Lyle (Project Coordinator), Agricultural Engineer-Irrigation Research, Texas A & M University Research and Extension Center (TAMU AREC), Lubbock, TX, Texas Agricultural Experiment Station (TAES), Rt. 3, Box 219, Lubbock, TX 79401-9757, Phone: (806) 746-6101. J. Wayne Keeling, TAES Systems Agronomist - Weed Scientist; Arthur B. Onken, TAES, Soil Chemist - Soil Fertility; Thomas L. Archer, TAES, Entomologist - Grain Crops; and Don R. Rummel, TAES Entomologist - Cotton.

Texas A & M University: Texas Agricultural Extension Service (TAEX), James R. Supak, Agronomist - Cotton Specialist; and Jackie G. Smith, Extension Economist.

Texas Tech University: Agricultural Research and Extension Center, (TAES), Eduardo Segarra, Economist.

Farmer Participants:

Donald Vogler, Lamesa, TX, Steering Committee, Lamesa Cotton Growers, Farmer; and David Nix, President, Lamesa Cotton Growers, Farmer.

Overview

Production systems are needed that efficiently utilize resources while reducing potential environmental impacts. We have developed and researched numerous technologies which individually address these problems and enhance agricultural production both ecologically and economically. We propose to integrate these technologies on a 160-acre farm equipped with a pivot Low Energy Precision Application (LEPA) irrigation system provided by a cotton growers association.

Integrated sustainable cotton production systems will be evaluated which include: 1) wheat-cotton conservation tillage rotation, 2) minimum tillage - continuous cotton, 3) terminated wheat-cotton, 4) sorghum-cotton conservation tillage rotation, 5) cotton-fallow-

wheat rotation, and 6) conventional tillage, continuous cotton. We will evaluate the interactive effect of high frequency (3 1/2 days), deficit (0.5 and 0.75 ET) LEPA irrigation with sequentially applied rates of N fertilizer (0.7, 0.85, 1.0 and 1.15 times the predictive amount) across all of the conservation tillage cropping systems. The data obtained will be used to evaluate the effectiveness of the cotton growth model GOSSYM. We will incorporate insect control with biorational insecticides (i.e. insect diseases, soaps and oils) into the sustainable cropping systems. These will be applied by low volume in-canopy LEPA chemigation nozzles which we have developed and by commercial LEPA chemigation nozzles.

Economic performance of all systems will be calculated using detailed records of inputs. A spreadsheet-based budget generator will be developed to provide enterprise budgets of the integrated cotton production systems. Information form the budget generator will be used to develop representative farm optimization models. Results from the farm will be relayed to producers with an annual field day, grower meetings, and a published annual report.

Objectives

We plan to use the entire farm to accomplish the following:

1. Assemble integrated sustainable cotton production systems consisting of interplanting cotton into cover crops, high residue rotations, conservation tillage, high frequency deficit LEPA irrigation, predictive sequential high frequency fertilizer application and biorational insect control with ultra low volume in-canopy application equipment.

2. Estimate the risk and environmental impact of the above practices in terms of decreased water and wind erosion, decreased nutrient leaching potential an pest management with environmentally safe chemicals.

3. Develop and economic model that farmers can use to make decisions concerning the implementation of integrated sustainable production systems.

Project Duration: 1 year (extended to January 31, 1994)

Funding: $60,000 Matching, $112,300.

LS92-48: DEVELOPING ENVIRONMENTALLY SOUND POULTRY LITTER MANAGEMENT PRACTICES FOR SUSTAINABLE CROPPING SYSTEMS

Major Participants:

Texas Agricultural Experiment Station (TAES): D. R. Earhart (Project Coordinator), Research Horticulturist - Vegetable Culture, Fertility, Texas A & M University (TAMU), Box E, Overton, TX 75684, Phone: (903) 834-6191.

Co-Project Coordinators:

TAES/TAMU:Overton, V.A. Haby, Soil Scientist, Chemistry, Fertility.

TAEX/TAMU:Overton, M. L. Baker, Extension Specialist, Fruits, Vegetables.

TAEX/TAMU: College Station, TX, F. J. Dainello, State Extension Specialist, Vegetables.

Oklahoma State University: D. McCraw, Extension Horticulturist, Vegetables, OCES, Stillwater, OK

Cooperators: Texas:

Cooperating Scientists and Texas A&M Personnel:

Texas Agricultural Extension Service (TAEX), Greg Clary, Extension Economist, Management, Overton, TX; Sim Reeves, Extension Agronomist, Forages; George Philley, Extension Plant Pathologist; James Robinson, Extension Entomologist.

TAMU: Bill Smith Statistician Dept. Statistics, College Station, TX.

(TAEX/TAMU) County Extension Agents Participating: Jackie Risner, Nacogdoches Co., Nacogdoches, TX; Jimmy McCelvy, Harrison Co., Marshall, TX.

Cooperators: Oklahoma:

Cooperating Scientists and Oklahoma State University Personnel:

Oklahoma State University: Jim Motes, Extension Horticulturist/Vegetables, OCES/OSU, Stillwater, OK. Bob Cartwright, Entomologist, Department of Entomology, OSU, Stillwater, OK; John Damicone, Plant Pathologist, Department of Plant Pathology; Joe Schatzer, Agricultural Economist, Department of Agricultural Economics.

Langston University: Nick Storm, Program Aid, Langston, OK.

Oklahoma State University: County Extension Agents Participating: Ron Vick, McIntosh/Okfuskee Co.,; and Joe Bullard, Haskell Co., OK.

Farmer Participants/Demonstration Farms: Texas:

George Millard, Farmer/Broilers, Vegetables, Millard Farms, Nacogdoches, TX. and William Suttle, Farmer/Vegetables, Hay, Cattle, Suttle Farms, Hallsville, TX.

Farmer Participants/Demonstration Farms: Oklahoma:

John Hale, Farmer/Watermelons, Peanuts,Hale Farm, Hanna, Ok; Stan Sheffield, Farmer/Greens, Soybeans, Sheffield Farm, Webbers Falls, OK; and Rayfield Robinson, Farmer/Watermelons, Robinson Farmer, Checota, OK.

Overview

Expansion of broiler production enterprises places a burden on producers to dispose of litter in a timely, profitable, and environmentally sound manner. Rate and application frequency are important environmentally and economically in any farming system. Disposal rates of broiler litter on producer-owned agricultural land are usually exorbitant due to insufficient available land areas. Proposed research will evaluate broiler litter in low-input, sustainable, vegetable production systems which will offer broiler producers opportunities to diversify into profitable alternative enterprises. Economic and environmental impacts of broiler litter rates and frequencies will be evaluated. Studies will identify litter application strategies which prevent excessive concentrations of nutrients in soils. The potential for reducing leaching of mobile ions into ground water and nutrient loss due to runoff will be determined. Costs of production and economic value of litter in alternative uses will be estimated. These parameters will be incorporated into economic models to evaluate the relative profitability of production systems where appropriate. Warm and cool season forage cover crops for hay and silage will be used to remove surplus nutrients in rotational cropping systems with vegetables. Research benefits to sustainable agriculture include the conversion of an environmental problem into profitable opportunities for producers. Results of this project will identify methods for reducing chemical inputs while disposing of poultry litter according to environmentally and economically sound management plans. Poultry litter will be shown to be an asset as a fertilizer instead of a liability as an environmental problem through the identification of application strategies which reduce nutrient pollution of ground water, soil nutrient imbalances, and loss to runoff.

Objectives

1. Evaluate the environmental and economic impact of broiler litter application rates and frequencies on selected vegetable crops.

2. Investigate the feasibility of growing warm and cool season annual forage crops in rotational cropping vegetable systems to remove excess nutrients supplied by poultry litter.

3. Determine nutrient loss due to runoff in a vegetable, forage, litter management system.

4. Demonstrate treatments from objectives 1 and 2 that show sound environmental and economic litter management practices on grower owned land under grower conditions.

Project Duration: 3 years, March 1, 1992 to February 28, 1995

Funding: $140,000 Matching, $116,669.

LS92-49: ORGANIC SOIL AMENDMENTS OF AGRICULTURAL BY-PRODUCTS FOR VEGETABLE PRODUCTION SYSTEMS IN THE MISSISSIPPI DELTA REGION

Major Participants:

Arkansas State University: Tina Gray Teague (Project Coordinator), Crop Production and Protection, On-Farm Research and Station Technical Advisor, College of Agriculture, P. O. Box 1080, State University, Jonesboro, AR 72467, Phone: (501) 972-2043. Paul W. Teague, Agricultural Economics, Production Economics and Marketing, Economic Analyses; Calvin Shumway, Crop Physiology and Plant Pathology, On-Farm Technical Advisor; and Perry Isbell, Agricultural Engineer, On-Farm and Station Technical Advisor.

University of Arkansas Cooperative Extension Service, Little Rock, AR: Gail S. Lee, Soil Science and Vegetable Production, On-Farm and Station Technical Advisor.

University of Arkansas at Pine Bluff: Owen Porter, Agronomy, On-Station Research and Bob Rode, Fisheries Production Systems, Waste Management, On-Station Research.

Rodale Institute, Fayetteville, AR: Janet Bachman, Horticulture, On-Farm Technical Advisor.

Mississippi State University: Kenneth Ferrell, Cooperative Extension, Swine Specialist, Waste Management Technical Advisor.

Virginia Polytechnic Institute and State University: Painter, VA, Susan B. Sterrett, Vegetable Production Systems, Organic Waste Management Technical Advisor.

Arkansas Land and Farm Development Corporation: Calvin King, Fargo, AR, Vegetable Grower, Farmer Cooperator.

Farmer Participants: The 14 USDA designated Alternative Crop Technology Farmers in eastern Arkansas: Ben Anthony, Sr.; Harvey Williams; Andrew and Arthur Bean; Larry Morgan; Abraham Carpenter, Sr.; James Sims; Victor and Ruby Gray; James Chappell; Lawrence Booker; Lem Anderson; Evans Johnson; Sam Shearin; and Charlie Ward.

Overview

The Lower Mississippi Delta Region -- Arkansas, Louisiana, and Mississippi, and parts of Illinois, Kentucky, Missouri and Tennessee -- boasts some of the greatest agricultural industries in the world, yet its people are among the most impoverished in the nation. Arkansas epitomizes the problems and potential of the region. Agriculture is the major

industry in the state, yet approximately 68% of Arkansas farms are considered small scale operations (annual sales less than $20,000). Many of these farms in eastern Arkansas (the Delta region) are operated by limited resource growers who may have marginally productive land. Profitability of their small scale operations has diminished due to the economics of scale accruing to the benefit of large scale operators. In response, many of these farmers have replaces all or a portion of their traditional crops of soybeans, rice or cotton with higher value crops such as vegetables. The production potential of their farms is limited with crops that require well-drained, highly fertile conditions.

Application of low cost agricultural waste products as soil amendments could provide improvements in soil productivity as well as financial savings compared to purchasing synthetic chemical fertilizers. Materials readily available in the region include animal manures, organic wastes from agricultural processing facilities such as cotton gins and rice mills, and dead animals. Appropriate handling of the waste materials as soil amendments also could aid in solving the massive waste disposal problems confronting the region.

We propose a 3 year project that would evaluate availability, agroecological impact, and economic accessibility of these waste products in vegetable production systems. Participatory research station and on farm research and demonstrations with growers will be included. The work initially will be focused toward 14 small scale vegetable farms operated by minority growers in 14 countries in eastern Arkansas. These farms have been designated by USDA agencies as Alternative Crop Technology farms and are being developed as model farms for vegetable production in the Delta region of Arkansas. They offer a unique opportunity for on-farm development and delivery of sustainable production methods to an accessible clientele in a highly visible program.

Objectives

1. Identify sources, composition, seasonal availability, variability and economic accessibility of agricultural by-products/wastes in the Lower Mississippi Delta Region.

2. Evaluate available information and determine experience of cooperator farmers on agroecological impact of these agricultural by-products/wastes.

3. Determine, in collaboration with farmer cooperators, the cultural, environmental, and economic impact of selected by-products on vegetable production.

4. Conduct participatory research/demonstration programs with cooperator farmers to determine effects of selected management and marketing approaches for several cropping systems utilizing promising soil amendments and methodologies.

5. Disseminate cultural and economic information obtained in a manner sociologically and educationally accessible to this farmer clientele.

Project Duration: 3 years

Funding: $140,000. Matching, $64,579.

LS92-50: PARTICIPATORY ASSESSMENT FOR STRATEGIC PLANNING IN SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION

Major Participants:

Community Farm Alliance: Dr. James V. Worstell (Project Coordinator), 200 Short Street #10, Berea, KY 40403. Phone: (606) 986-7400.

University of Kentucky: Dr. David Debertin, Agricultural Economics, Rm 410 Ag Engineering Bldg., Lexington, KY 40546-0276. Phone: (606) 257-7258.

University of Georgia: Dr. Robert Rhoades, Dept. of Anthropology, Athens, GA 30602. Phone: (706) 542-3922. Virgil Huston, Dept. of Anthropology.

Other Cooperating Agencies/Groups:

Cooperative Extension Service
U.S. Environmental Protection Agency
Soil Conservation Service
Southern Sustainable Agriculture Working Group
Administrative Council of the SARE/ACE program

Overview

The goal of this project is to organize a comprehensive, region-wide description of the "State of the South" in sustainable agriculture as a means of assisting strategic planning by the Administrative Council of the Southern Region SARE/ACE program. Completion of this project will provide analyses of the major constraints to sustainability of southern agricultural systems and the best opportunities in research and education for removing those constraints.

Definitions and Indicators. Operational definitions of sustainable agriculture (SA) show a wide disparity across the South. Definitions range from equating SA with no use of pesticides and fertilizer to defining all present agricultural research activities as sustainable; however, a consensus seems to be emerging that sustainable systems combine productivity, profitability, wise use of inputs, and protection of the environment. Nonetheless, disagreement still exists and will likely never be completely removed. One solution is to adopt the definition of SA in the 1990 Farm Bill; but adopting this definition to facilitate planning must be done such that the definition does not obscure needs and opportunities which don't fit neatly within its boundaries. The best way to accomplish this is by sampling multiple perspectives with both structured and open-ended methods in an iterative process.

Multiple Perspectives. Multiple perspectives will be incorporated by three approaches: secondary database integration; Extension SCS surveys; and agro-ecoregion-based farmer input leading to joint farmer-researcher perspectives. These three approaches each give a necessary part of the picture. Together they will provide access to the multiple perspectives needed to determine the best opportunities for SA research and education in the South.

Objectives

The overall objective is to organize a comprehensive, region-wide description of the "State of the South" in sustainable agriculture. This main objective can be further subdivided into the following:

(1) Focus Groups: to conduct focus groups in a number of important subregions and commodity systems. These groups will consist of farmers, bankers, agribusinessmen, county agents, SCS staff, experiment station staff, non-profit groups, etc.

(2) Farmer-researcher networks: to organize a series of visits by farmers to all major Experiment Stations in each of 6 sub-regions and to plan for Sustainable Agriculture Opportunity Workshops in each region. The main benefit to researcher participation will be uncovering researchable ideas and interested collaborators. The main benefit to farmers will be recruiting researchers to solve the problems which prevent them (the farmers) from making maximal progress toward sustainability.

(3) Survey: to administer a survey to all county Extension offices and to District Conservationists of the Soil Conservation Service, and to analyze and distribute the results to Extension, SCS, and Experiment Stations.

(4) Secondary database analysis: To integrate databases from EPA, SCS, and others to generate composite pictures of factors related to agricultural sustainability at the county level, using Geographic Information System (GIS) technology. Final results will also detail gaps in existing data and make recommendations to data collecting agencies to improve the usefulness of their data to SA research and education planning.

Project Duration: 3 years total

Funding: $37,500 in 1992. Matching, $55,500 in 1992.
$90,550 in 1993. Matching, $57,313 in 1993.

LS93-51: WARM-SEASON FORAGE GRASSES AS ROTATIONS FOR SUSTAINING PROFITABLE PEANUT PRODUCTION

Major Participants:

Auburn University, AL: Rodrigo Rodríguez-Kábana (Project Coordinator), Plant Pathology Department, Researcher, Nematology, Phone: (205) 844-1976. Kira L. Bowen, Plant Pathology Department, Researcher, Epidemiology, Aflatoxins. David I. Bransby, Agronomy and Soils Department, Researcher, Forage Systems. Joseph W. Kloepper, Plant Pathology Department, Researcher, Agricultural Microbiology. Neil Martin, Jr. Agricultural Economics and Rural Sociology Department, Researcher, Economics.

Overview

Peanut production in the Southeast is currently limited by damage from root-knot nematode, southern root rot, and contamination with aflatoxins. Nematodes often interact synergistically with soilborne pathogens and may increase contamination of peanut seed with aflatoxigenic fungi.

The goal of this project is to develop profitable and sustainable peanut production systems that will suppress nematodes and other soil-borne pathogens, reduce or eliminate pesticide use, and enhance cattle production.

Objectives

(1) To assess the potential of peanut rotations with switchgrass to suppress infection by aflatoxigenic fungi, root-knot nematodes, and other soil-borne pathogens of peanut within integrated peanut and forage-livestock production systems.

(2) To study the effect of selected warm-season forage grasses on populations of aflatoxigenic fungi, nematodes, and other soil-borne pathogens of peanut.

(3) To evaluate the level and variability of implied net returns from all treatments if adopted on a commercial scale.

(4) To determine the impact of switchgrass and other selected warm-season forage grasses on the species diversity and species richness of indigenous soil, rhizosphere, and geocarposphere microbial communities.

Project Duration: Two years

Funding: $183,000. Matching, $48,500.

LS93-52: UTILIZATION OF DAIRY MANURE IN LOW-INPUT, CONSERVATION TILLAGE ANIMAL FEED PRODUCTION SYSTEMS

Major Participants:

University of Tennessee: Michael D. Mullen (Co-project Coordinator), Assistant Professor, Plant and Soil Science Department, PO Box 1071, Knoxville, TN 37901-1071. Phone: (615) 974-8817. Bobby N. Duck, Professor, Crop Sciences Department, Martin Agricultural Experiment Station. H. Paul Denton, Associate Professor, Water Quality and Soil Management Extension Specialist. John K. Bernard, Associate Professor, Ruminant Nutrition, Animal Science Department, Martin Agricultural Experiment Station. Donald D. Tyler, Professor, Soil Management, Plant and Soil Science Department, West TN Agricultural Experiment Station.

Tennessee Valley Authority, Agricultural Institute: Karen E. Simmons (Co-project Coordinator), Research Soil Scientist. Larry A. Johnson, Agricultural Economist and Program Manager, Agri-21 Farming Systems.

Farmer Participants:

Rabon Bayless, Dairy Farmer, Ardmore, TN. Denton Bell, Dairy Farmer, Martin, TN.

Overview

It is important that nutrients in animal waste are recycled within the farming operation to produce feed, thereby reducing dependence on off-farm inputs and maximizing production efficiency. It is also important that wastes be managed to minimize off-site deterioration of water resources. The goal of this project is to develop manure application guidelines for Tennessee and the southern region.

Thirty-three plots at two locations in the state have been established and instrumented with pan lysimeters to collect leachates. Equipment to collect surface runoff is being added. Water quality parameters, yields, feed quality, and biological and chemical soil properties will be evaluated.

Objectives

(1) To evaluate rates and timings of manure N and P applications in no-tillage silage production which will produce agronomic, environmental, and economic benefits relative to inorganic fertilization.

(2) To evaluate the potential impacts of liquid dairy manure applications in no-tillage silage and haylage rotations on surface and subsurface water quality deterioration.

Project Duration: Three years

Funding: $90,635. Matching, $36,123.

LS93-53: SUSTAINABLE WHOLE FARM GRAIN/SILAGE PRODUCTION SYSTEMS FOR THE SOUTHEAST

Major Participants:

Auburn University, AL: D. W. Reeves (Co-project Coordinator), Research Agronomist, USDA-ARS Soil Dynamics Laboratory and Adjunct Associate Professor, Agronomy and Soils Department, USDA-ARS NSDL, 235 Funchess Hall, Auburn University, AL 36849. Phone: (205) 844-3996. G. L. Mullins (Co-project Coordinator), Associate Professor, Soil Fertility, Agronomy and Soils Department. E. van Santen, Associate Professor, Forage Geneticist, Agronomy and Soils Department. J. R. Crews, Associate Professor, Extension Agricultural Economist, Agricultural Economics Department. B.

R. Moss, Professor, Animal and Dairy Science Department. P. L. Mask, Associate Professor, Extension Grain Crops Specialist, Agronomy and Soils Department.

University of Florida: D. L. Wright (Co-project Coordinator), Professor, Research and Extension - Agronomy Department, North FL Research and Education Center, Quincy, FL. R. K. Sprenkel, Associate Professor, Research and Extension - Entomology, North FL Research and Education Center, Quincy, FL.

USDA-ARS: W. W. Hanna, Research Geneticist, USDA-ARS Forage and Turf Research Unit, Coastal Plain Experiment Station, Tifton, GA.

Cooperators:

Resource Seeds, Inc., Gilroy, CA: G. E. Aksland, Plant Breeder.

Pioneer Hybrid International, Inc., Huntsville, AL: R. G. Palmer, Agronomist.

Alabama Farmers Federation, Wheat and Grain Division, Montgomery, AL.

Overview

Sustained economic viability and environmental quality of farms in the Southern Region can be improved by diversified whole farm systems that effectively integrate livestock cropping systems. These systems must, however, be adapted to the acid infertile soils of the region. Traditional mono- and doulblecropping systems based on more productive soils and climatic conditions of the Midwest are not economically feasible in the Southern Region. This project will determine the potential of new systems that are adapted to the unique edaphic and climatological conditions of the humid South. The systems, using new or improved crop species adapted to the region, could:

- Have the advantages of current legume cover crop systems in conserving soil and water resources but be more profitable due to the value of grain and silage produced;
- Provide a rotation yield response to summer grain and silage crops;
- Contribute to reducing or eliminating N fertilizer input;
- Fit well into a diversified crop/livestock system through on-farm utilization of high-protein feed grain and silage produced;
- Reduce pesticide applications;
- Increase profitability by on-farm production and use of high-protein grain feed grain, reduction in fertilizer and transportation costs, and better utilization of land, labor, machinery/equipment and other resources.

Objectives

(1) To develop profitable alternatives, using white lupin, tropical corn, and hybrid pearl millet to current grain and silage production systems employed by farmers in the Southeast.

(2) To develop sustainable systems utilizing these alternative crops that integrate into diversified (crop/livestock) farming systems and result in reduced pesticide and fertilizer inputs and conservation of soil, water, and energy.

(3) To determine the profitability of production systems using these alternative crops as compared to traditional systems currently employed by farmers in the Southeast and disseminate this information to farmers through farm meeting, popular press articles, extension publications, videos, and television.

Project Duration: Three years

Funding: $240,639. Matching, $218,600

LS93-54: EVALUATION OF LOW-INPUT, NO-TILL, NO-HERBICIDE CONTINUOUS GRAZING SYSTEM FOR DAIRY COWS

Major Participants:

Clemson University, SC: Jean A. Bertrand (Project Coordinator), Associate Professor, Dairy Science Department, PO Box 340361, Clemson, SC 29634-0361. Phone: (803) 656-3230. Fred Pardue, Professor, Dairy Science Department. Bruce Pinkerton, Associate Professor, Agronomy Department.

Farmer Participant:

Tom Trantham, Trantham Dairy Farm, Pelzer, SC.

Overview

Diary farming has become a very high-input, highly intense business. Environmental regulations are forcing many dairy producers to consider alternative ways to produce milk. Also, many dairy farmers have been under severe financial stress due to low milk prices and increasing costs. Since feed costs represent over 50% of the cost of producing milk, every effort must be made to study alternative, more economical feeding systems.

This project will be conducted on a 92 acre dairy farm located 30 miles east of the Clemson University campus. The project will study and evaluate a low-input, no-till, no-herbicide continuous grazing system for dairy cattle. This system should offer both environmental and economic advantages over conventional, high-input confinement systems.

Objectives

(1) To design and evaluate a year-round no-till, no-herbicide continuous grazing system for dairy cattle.

(2) To determine if grazing systems improve animal health when compared to conventional confinement systems.

(3) To evaluate economic and environmental effects from changing from a total silage-based feeding program to no-till, no-herbicide, limited commercial fertilizer year-round grazing system.

Project Duration: Three years

Funding: $118,911. Matching, $62,700.

LS93-55: COVER CROP INTEGRATION INTO CONSERVATION PRODUCTION SYSTEMS FOR COTTON AND SORGHUM

Major Participants:

USDA-ARS National Sedimentation Laboratory: Seth M. Dabney (Project Coordinator), Agronomist, PO Box 1157 Oxford, MS 38655. Phone: (601) 232-2975.

University of Arkansas: Terry Keisling, Agronomist, Marianna, AR.

University of Tennessee: Bob Duck, Agronomist, Martin Agricultural Experiment Station, Martin, TN.

USDA-SCS Jamie Whitten Plant Materials Center: Herbie Bloodworth, Agronomist, Coffeeville, MS.

USDA-ARS National Soil Dynamics Laboratory: Wayne Reeves, Agronomist, Auburn, AL.

Rodale Research Institute: Janet Bachmann, Southern Region On-Farm Research Coordinator, Fayetteville, AR.

ATTRA: Teresa Maurer, advisor, video taping, distribution of results, Fayetteville, AR

Farmer Participants:

Lorna McMahon, organic cotton farmer, Tiptonville, TN.

Jim Whitfield, cotton and soybean farmer, Yazoo City, MS.

David Denton, sorghum and rice farmer, Tyronza, AR.

Overview

Cotton is the highest value but most erosive agronomic crop grown in the southern region. No-till farming can reduce erosion but frequently relies on increased herbicide applications. This project will use replicated small-plot experiments and on-farm adaptive trials to identify germplasm and to develop, document, and demonstrate alternative cover crop and conservation tillage management practices, with the aim of increasing productivity while decreasing reliance on purchased inputs by both conventional and organic producers. The economics of alternative management systems will be analyzed as well.

Objectives

(1) To identify legume cover crop germplasm and practical management/rotation systems which allow cover crops to mature hard seed and volunteer back in the fall.

(2) To demonstrate the use of mechanical means to kill cover crops ahead of no-till planting cotton and sorghum in plots and field-scale plantings.

(3) To evaluate the use of cover crop residue mulches to reduce weed competition with the summer crops of cotton or sorghum on organic and commercial farms.

(4) To perform and economic analysis of alternative cover-crop management systems.

(5) To make results of this research available to farmers of all types.

Project Duration: Three years

Funding: $135,540. Matching, $117,040.

PART III. SOUTHERN REGION ACE PROJECTS FUNDED, 1992-1993

Table Of Contents of Part III

AS92-1: AN INTEGRATED TECHNOLOGICAL AND MARKETING STRATEGY TO MAKE BROILER PRODUCTION MORE SUSTAINABLE

PRIMARY INSTITUTION: Winrock International

OBJECTIVES:

The goal of this integrated education, research and demonstration project is to increase utilization of poultry litter produced in western Arkansas and eastern Oklahoma in ways that increase its economic value and protect ground and surface water quality. This three-year project has two kinds of objectives. Broad **results objectives** are listed first. **Process objectives** along with the expected outcomes are listed below.

Results Objectives

(1) Identify and demonstrate economically and environmentally sound on- and off-farm nutrient management strategies that produce a consistent-quality broiler litter for sale at times when its use is environmentally appropriate and when demand is the greatest.

(2) Establish a more formal market for broiler litter in order to (a) make it easier for grower and contractors who clean broiler houses (clean-out contractors) to find buyers, (b) increase the price of litter to its real economic value as a source of nutrients and organic matter for plant and animal production, (c) get more environmentally-sustainable distribution of litter, and (d) provide a price incentive to encourage more wise application of litter and potentially improve farm profitability.

(3) Improve growers', clean-out contractors', litter processors' and end-users' knowledge of the inter-relationships between production, processing, marketing and utilization of litter, its nutrient content, its value, and its proper handling.

Process Objectives

The process objectives described below represent an integrated response to the situation which exists in wester Arkansas and eastern Oklahoma. Eight process objectives are described below.

1. **Analyze existing informal marketing practices.**

1a. Planned Activity. Conduct case study analysis of existing marketing practices trough interviews with growers, integrators, clean-out contractors, row crop farmers, ranchers, extension agents, SCS field staff, conservation district technicians, and others. **Product:** Project bulletin. **Outcomes:** Establish a baseline understanding for comparison and evaluation of project's progress. Improve understanding of how existing informal markets function. **Responsible organization:** Winrock (work related to Millwood Watershed and Biomass Resource Utilization projects)

2. **Develop strategies to reduce variability of raw litter.**

2a. Planned Activity: Analyze chemical and structural variability of litter from broiler houses at different locations in the house after each flock of birds is removed to determine potential to use fractionization technologies being developed by University of Georgia to separate "fines' for sale to producer of bagged potting soil and recycle "coarse" litter for reuse in broiler production. Growers from Hudson farms will participate in this research. Grace Sierra Horticultural Products, located in Hope, Arkansas, and a supplier of bagged potting soil to Walmart, Inc., has agreed to review the research results. **Product:** Technical paper. **Outcomes:** Potential new market for litter. Testable hypotheses and preliminary recommendations to integrators and growers. **Responsible organization:** Southwest Arkansas Agricultural Research and Extension Center, Hope.

2b. Planned Activity: Determine how selected entrepreneurs producing processed litter products are handling variability of raw litter, including ReLeaf Corp, Mulberry, AR; OrganiGro, Inc., Watts, OK; and TA Feeds, Morrilton, AR. **Product:** Results reported in research paper above. **Outcome:** Identification of processing alternatives to deal with variability.

3. **Encourage growers to invest in litter storage facilities.**

3a. Planned Activity: Construct stacking sheds on three to five demonstration farms in the project area. Growers from Tyson Foods and Hudson Farms will participate. Select growers who lack enough acreage for land application, agree to use the 1-800 hot line to find buyers for their litter (see 4a below), consent to follow a site-specific nutrient management plan (see 3b below), and will allow their operations to be used for field days and other educational activities. **Product:** Project bulletin. **Outcomes:** Increased flexibility of timing of use/sales for participating farmers. Minimize run-off and leaching associated with land application under inappropriate conditions. Demonstration of benefits to farmers who can take advantage of ASCS 75% cost share available through Water Quality Demonstration Project in FY1993. **Responsible organization:** SCS and Oklahoma CES.

3b. Planned Activity: Prepare nutrient management plans for demonstration farms with stacking sheds. **Products:** Example nutrient management plans. Project bulletin. **Outcomes:** Determine what is "excess" litter and available for sale on demonstration farms. Demonstrate relationship between on-farm nutrient management and off-farm sales strategy. **Responsible organization:** SCS and Oklahoma CES.

3c. Planned Activity: Review literature and farmer experience on stacking shed design: roofed structure, concrete bunker with plastic cover, piled storage under plastic, and open pile storage for cost, labor and equipment requirements, environmental factors, and effectiveness in heat-treating litter for feeding to cattle. **Product:** Technical paper. **Outcome:** Preliminary recommendations for storage

suitable for Arkansas/Oklahoma conditions. Testable hypotheses for further research. **Responsible organization:** depends on availability of additional funds.

4. **Bring buyers and sellers together.**

4a. Planned Activity: Establish a 1-800 hot line telephone where buyers and sellers from Oklahoma and Arkansas can call to locate or sell litter. Promote hot line in project area and row cropping areas of the Mississippi River Delta. Hot line operator will offer callers information on soil, litter, and plant tissue testing services, and make buyers and sellers aware of each other. **Product:** Established mechanism to improve functioning of the market. Project bulletin. **Outcomes:** Expanded sales of litter originating in project area. Improved distribution of litter minimizing water quality degradation. Increased public awareness of broiler litter as a useful product. **Responsible organization:** Winrock.

5. **Improve buyers' and seller's knowledge of litter prices.**

5a. Planned Activity: Project coordinator will periodically report litter prices. **Product:** A series of news releases. **Outcomes:** Improved market clearing. Responsible organization: Winrock International.

5b. Planned Activity: Analyze economics of marketing and hauling poultry litter. Using data from 1-800 hot line, track selling price of litter, and location of buyer and seller. Conduct followup interviews with selected buyers and sellers to determine how litter price was established, how litter was transported, hauling costs, and other terms of sale. Analyze price variations by season and over time. Periodically publish prices. **Products:** Periodic reporting of price information. Technical paper. **Outcomes:** Less price variation from transaction to transaction. Reduced transaction costs. Prices should more closely reflect the real economic value over time. **Responsible organization:** Arkansas CES and Winrock.

6. **Identify and train clean-out contractors.**

6a. Planned Activity: Through interviews with growers, integrators, extension agents, and SCS field staff, identify clean-out contractors in the project area. Conduct a series of workshops for clean-out contractors on calibration of spreaders; nutrient management; soil, litter and plant tissue testing; regulatory issues; etc. Identify two-three clean-out contractors who are interested in adding value to their hauling and cleaning services, and work with them on a one-to-one basis to begin offering soil, litter and plant tissue testing services. Encourage clean-out contractors to use telephone hot line to identify buyers. **Products:** Eight to 12 days of training. Easily readable highly visual field manual for clean-out contractors. **Outcomes:** Improve contractor's knowledge to reduce water quality problems associated with land application at inappropriate times, sites, and rates. Improved profitability over time. Lay the groundwork for a voluntary certification program. **Responsible organization:** Arkansas CES and Oklahoma CES.

7. **Identify, evaluate and arrange least-cost transportation of litter.**

7a. Planned Activity: Using data from telephone hot line, plot the distance the buyers transport litter. Interview buyers who haul litter more than 30 miles to determine means of transport, cost, utilization, and buyer's evaluation of the perceived costs/benefits. **Product:** Technical paper. **Outcomes:** Expanded knowledge of buyer's willingness to pay for hauling litter. Input for further economic research. **Responsible organization:** Arkansas CES.

7b. Planned Activity: In promotional materials publicizing 1-800 hot line in Mississippi River Delta, offer assistance in arranging backhauls. Identify independent Delta-based truckers who regularly backhaul empty from the project area to eastern Arkansas. Assist growers, clean-out contractors, truckers, and end-users in arranging backhauls of litter going east. **Product:** List of truckers who could provide backhauls. Expanded base of experience in arranging backhauls. **Outcomes:** Improved understanding of informal markets for west-east backhauls. Potential removal of litter from areas where litter threatens water quality. Productive use of litter in the Delta. Potential expanded demand for litter in the Delta. **Responsible organization:** Arkansas Delta Council and Winrock.

8. **Recommended strategies to increase demand for litter.**

8a. Planned Activity: Interview key decision-makers to determine their experiences and attitudes about poultry waste as a feed. Interviews will be conducted with each of the following groups: 1) farmers and ranchers a) with experience feeding litter who feel positive about its use as feed; b) with experience feeding litter who feel negative about its use as feed; c) without experience feeding litter but are interested in learning about its potential benefits; and d) without experience feeding litter who reject its use out of hand; 2) feedlot managers, 3) nutrition consultants, and 4) extension beef specialists. Review extension materials from throughout poultry-producing regions, and summarize recommendations. Identify differences among recommendations. **Outcomes:** Improved understanding of experience and attitudes about feeding litter to cattle. Expanded awareness of the potential benefits of feeding litter to cattle among feedlot managers, consultant nutritionists, and extension beef specialists. **Products:** Research paper. Conference. **Responsible organization:** Winrock.

8b. Planned Activity: Document and evaluate marketing strategies of the following firms that are selling producing and selling processed litter products (e.g., ReLeaf Corp., Mulberry, AR; OrganiGro, Inc., Watts OK; and TA Feeds, Morrilton, AR). **Product:** Research paper. **Outcomes:** Groundwork laid for joint public awareness program aimed at increasing demand for processed litter products. Improved understanding of markets for processed litter products. Recommendations to processors to improve their marketing strategies. **Responsible organization:** Winrock.

8c. Planned Activity: Analyze heavy metal concentrations in raw litter, deep stacked litter, and pastures. **Product:** Technical recommendations for cattle feeding and technical report. **Outcome:** Greater willingness on the part of extension specialists and cattlemen to feed poultry litter to cattle. **Responsible organization:** Oklahoma State University.

PROJECT DURATION: Three years

FUNDING: ACE Total $200,000 for 3 years, starting 1992
Matching Funds Total: $101, 409

PROPOSAL:

Broiler waste is a growing threat to water quality in western Arkansas and eastern Oklahoma. At the same time, soil organic matter and fertility are declining in eastern Arkansas' Mississippi River Delta. Historically, it has been assumed that poultry litter's value was too low to justify hauling it any significant distance. A growing body of both research and experience suggests that litter has greater value than previously assumed. Typically, researchers have analyzed demand for litter by evaluating its benefits (e.g., nutrient content), and comparing the value of these benefits to substitutes with known prices which produce similar benefits. This project takes a behavioral approach to determine litter's value and analyze demand. We establish mechanisms to bring buyers and sellers together, provide price information, reduce variability of raw products, improve growers' flexibility for the timing of sales, and expand utilization. Then, we document and analyze the experience of those involved in producing, marketing, and utilizing litter. Education and case studies are an integral part of each activity.

MAJOR PARTICIPANTS:

Winrock International: Sandra E. Miller (Project Coordinator), Agricultural Economist, Rural Development Specialist, Rt. 3, Box 376, Morrilton, AR 72110. Phone: (501) 727-5435, ext. 260; Frank H. Baker, Animal Scientist and James M. Wimberly, Agricultural Engineer, Biomass, Resource Utilization Specialist.

University of Arkansas Experiment Station: J. Mike Phillips, Agronomist, Research Scientist, SW Arkansas Experiment Station, Hope AR 71801.

Arkansas Cooperative Extension Service: Eddie Hubbell, Non Traditional Education, Specialist Extension Administration, P.O. Box 391, Little Rock, AR 72202. Phone: (501) 671-2000, and Wayne P. Miller, Agricultural Economist, Extension specialist, Phone: (501) 671-2085.

University of Arkansas-Fayetteville: T. Lionel Barton, Poultry Scientist, Extension Specialist, Dept. of Animal & Poultry Science, (C-103), Fayetteville, AR, 72701. Phone: (501) 575-6529.

Oklahoma Cooperative Extension Service: James Britton, Poultry Scientist, Extension Specialist, P.O. Box 430, Poteau, OK 74953. Steven C. Smith, Animal Scientist, Extension Specialist, Extension Center - Court House, McAlester, OK 74501. Phone: (501) 423-5519.

USDA, Soil Conservation Service: Ken Sites, Pasture Management Specialist, Soil Conservationist, Federal Office Building, 700 West Capitol Avenue, Little Rock, AR 72201, Phone: (501) 324-6138.

USDA, Soil Conservationist: Marion T. Mathis, Resource Conservationist, Soil and Water Conservation Specialist, Rt. 4, Box 1718, Hope, AR 71801, Phone: (501) 777-8613.

Arkansas Delta Council: Kevin Smith, Economics, Rural Development, c/o Rice Research Station, Stuttgart, AR 72160, Phone: (501) 673-2132.

PARTICIPATING FARMERS: Paul Britt, Farmer and Plant Manager of Tyson Foods, Nashville, Arkansas, Poultry Production Activities, Tyson Foods of Nashville, 100 East Cassady, Nashville, AR 71852, Phone: (501) 845-1455 and James Duke, Farmer and Broiler Production Manager of Hudson Farms, Poultry Production, Southwest Arkansas, Hudson Farms, Box 230, Hope, AR 71801, Phone: (501) 777-7105.

AS92-2: HABITAT ENHANCEMENT FOR BENEFICIAL INSECTS IN VEGETABLE AND FRUIT FARMING SYSTEMS

PRIMARY INSTITUTION: Rodale Institute in Pennsylvania

OBJECTIVES:

(1) To screen selected plant species, including cover crops, for attractiveness and habitat value to predators and parasitoids of key pests of cabbage and squash.

(2) To develop production systems for cabbage and squash using habitats altered to favor natural enemies.

(3) To evaluate these agroecosystems, including economic comparisons with monocropped systems.

PROJECT DURATION: Three years

FUNDING: ACE Total $200,000: for 3 years.
Matching Funds Total: $79,975.

PROPOSAL:

The success of sustainable agriculture systems depends on the ability of ecological and agricultural processes to complement each other. We can use the principles governing natural systems to help us create agroecosystems with long term resilience and stability. Understanding the dynamics and interactions of plant, insect, and insect predator populations in cropping systems can lead to innovative approaches to pest management. (Bugg and Wilson, 19989; Bugg et al, 1990).

Our proposed research seeks to develop and evaluate cropping systems that incorporate the use of companion and/or cover crops to enhance levels of biological control of key pests of cabbage and squash. The integrated agroecosystems for these vegetables will serve as models for expanded research with other plants and herbivores in other locations. The critical question is - can selective management of adjacent vegetation have a positive impact on pest management in crop systems? Critical questions from a whole-farm perspective are - can such modifications fit into the day-to-day operations, and are they economically viable?

Research will be carried out on-station and on-farm in Arkansas and Oklahoma, and on-station in Alabama. Information gained from the research will be disseminated through field days, meetings and workshops, Cooperative Extension bulletins, popular trade journals and farm publications.

MAJOR PARTICIPANTS:

Rodale Institute, Arkansas: Janet Bachmann, (Project Coordinator), horticulture, on-farm technical advisor. Phone:

Kerr Center for Sustainable Agriculture: George Kuepper, agronomy, horticulture, on-farm technical advisor, Poteau, OK.

ATTRA: Teresa Maurer, ecology, technical advisor, Fayetteville, AR.

Oklahoma State University: Robert Cartwright, entomology, on-station research, WWAREC, Lane, OK.

Oklahoma State University: Raymond Eikenbary, biocontrol, parasitoid identification, Stillwater, OK.

Arkansas State University: Tina Gray Teague, entomology, on-station research; and Paul W. Teague, agricultural economics, technical advisor, State University, AL.

Auburn University in Alabama: Geoff Zehnder, entomology, on-station research; and David Himelrick, horticulture, on-station research, Auburn, AL.

FARMER COOPERATORS:

Arkansas: Mark Cain, Huntsville; John and Terry Matthews, Jasper; James and Julia Gibbons, Ozark; James Luken, Fayetteville; and Sue and Rusty Nuffer, Jerusalem, AR.

Oklahoma: Betty and Ray Carter, Poteau; Edwin Kessler, Purcell; Bill Sears, Talihina; Sam Forbes, Spencer; and Bob Constein, Perkins, OK.

AS92-3: INTEGRATION OF NATURAL ENEMIES FOR MANAGEMENT OF THE SWEETPOTATO WHITEFLY AND ASSOCIATED DISORDERS ON MIXED-CROPPED VEGETABLES

PRIMARY INSTITUTION: University of Florida

OBJECTIVES:

(1) Evaluate intercropping marketable crops for the manipulation of sweetpotato whitefly (SPWF) populations and the viruses they vector on tomatoes in Florida and cucurbits in Texas.

   a. Investigate the effects of crop combinations on insect pest populations, especially SPWF, and the incidence of insect-vectored viruses.

   b. Evaluate the response of natural enemy populations of the SPWF to intercropping and multicropping systems.

   c. Determine if artificial food sources and attractants or beneficial insect releases are cost-effective in maintaining and increasing beneficial insect species in a multicropping system.

(2) Estimate the profitability of the methods employed to manage the SPWF on vegetables.

   a. Document the costs of the various inputs and determine the profitability of the management methods investigated.

   b. Develop a budget that can be used to estimate the cost effectiveness of such management practices.

(3) Disseminate information to growers and extension personnel throughout the Southern Region.

PROJECT DURATION: Two years.

FUNDING: ACE Total $170,000 for 2 years.
Matching Funds Total: $77,789

PROPOSAL:

The sweetpotato whitefly (SPWF), Bemisia tabaci (Gennadius), became a major pest in Florida in 1986 and in Texas in 1990, and presently in damaging agronomic and horticultural crops across the Southern Region; of the US. Damage occurs through feeding, honeydew deposition, injection of toxins and transmission of viral plant diseases. SPWF has been associated with irregular ripening of tomato and has been shown to transmit a new geminivirus of tomato, Tomato Mottle Geminivirus (TMGV). To avoid losses from irregular ripening and TMGV, commercial growers typically apply insecticides two to three times weekly;. This heavy insecticide use has resulted in reduced grower profitability, increased exposure of farm workers and families to insecticides, increased insecticide residues in crops and increased insecticide resistance in the whitefly. Annual losses in tomato including indirect control costs and direct yield losses are conservatively estimated at about $125 million in Florida.

Commercial crops such as squash and sunflower will be intercropped or strip-cropped with tomato or other susceptible crops on organic farms in Florida and Texas. The intercrops will serve as refuges for beneficial insects attacking B. tabaci and as trap crops for immigrating adults and SPWF-vectored geminivirus. Specific cultural practices such as yellow or UV-reflective mulch and petroleum oils will be used to inhibit movement of SPWF into the main crop. Manipulation of beneficial species onto the main crops will be accomplished through the use of artificial food supplements, attractants for specific natural enemies of the SPWF and augmentative releases of natural enemies. Populations of SPWF and other pests as well as beneficial insects will be monitored twice weekly and compared with crops on conventional farms. An economic analysis will be made for each situation over the season to estimate the profitability of the integration of the various practices employed. Cost effective methods which lend themselves to adoption and integration into current cultural and management methods will be made available to growers through on-site field days, articles in trade and extension publications and presentations at grower meetings.

MAJOR PARTICIPANTS:

University of Florida: David J. Schuster, (Project Coordinator), Professor of Entomology, Gulf Coast Research and Education Center, 5007 60th Street East, Bradenton, FL 34203, Phone: (813) 751-7636; and J. E. Polston, Assistant Professor of Plant Pathology. P. A. Stansly, Assistant Professor of Entomology, Southwest Florida Research and Education Center, P. O. Drawer 5127, Immokalee, FL, 33934-9716; and D. J. Zimet, Associate Professor of economics, North Florida Research and Education Center, Route 3, Box 4370, Quincy, FL 32351-9529.

Texas A & M University: M. Rose, Research Scientist, Biological Control Center, College Station, TX 77843.

FARMER PARTICIPANTS:

Florida: A. Derting, Organic Farmer, Pine Island Organics, Pine Island, FL.

Texas: H. M. Hitchcock, Sr., Organic Farmer, Hitchcock Farms, 5400 Rogers Lane, Austin, TX 78724.

COOPERATORS:

University of Florida: T. B. Cole, Extension Agent II, Lee County Extension Unit, 3406 Palm Beach Blvd., Ft. Myers, FL 33905-3719; and C. S. Vavrina, Assistant Professor of Vegetable Horticulture, Southwest Florida Research and Education Center, P. O. Draver 5127, Immokalee, FL 33934-9716.

AS92-4: CROPS, THE CROP ROTATION PLANNING SYSTEM, FOR WHOLE-FARM ENVIRONMENTAL AND ECONOMIC PLANNING

PRIMARY INSTITUTION: Virginia Polytechnic Institute & State University

OBJECTIVES:

(1) Implement and evaluate a whole farm planning system (CROPS) to assist farmers in developing crop rotation plans, adopting environmentally sound practices, and complying with state and federal land-use regulations.

(2) Expand the livestock component of the CROPS system to include manure management.

(3) Improve the economic evaluation component of CROPS by establishing data and file-transfer linkages with the PLANETOR program.

(4) Modify CROPS for vegetable production systems and test it on a small scale vegetable farm.

PROJECT DURATION: Two years.

FUNDING: ACE Total $140,000 for 2 years.
Matching Funds Total: $88,247.

PROPOSAL:

The CROPS system is a computer program that addresses the farm-level problem of sustainable agriculture: how does a farmer implement sustainable practices on a particular farm? Given a set of goals for production levels of specific crops, a map of the farm's fields with associated soil and topographic data, and economic information about the farm, the CROPS program can generate a whole-farm plan over a six-year planning horizon. The plans generated are repeating; they meet the requirements of the soil conservation service; and, they incorporate the principles of sustainable agriculture, promoting reduced leaching and runoff of nutrients and pesticides while maintaining economic profitability.

CROPS has been under development for the last two years. It was funded by the old Southern Region LISA program for one year, and it has received some support from the Virginia Corn Board and indirectly from the Virginia Department of Conservation and Recreation. It is now at the point that it needs to be actively tested in the field and modified to add more realism. The program has been thoroughly tested and demonstrated and has been used to develop farm plans for two cooperating farmers.

This proposal would expand the applicability of CROPS to include relatively unconstrained farming operations like vegetable producing farms; it would add more detail in the areas of livestock and manure management, and it would provide for field testing by four cooperating farmers in two states. The final product would be a system that is deliverable to individual farmers, complete with a user's manual and tutorial.

MAJOR PARTICIPANTS:

Virginia Polytechnic Institute & State University: Nicholas Stone, (Project Coordinator), Research/Teaching in systems Science, Department of Entomology, 202 Price Hall, Blacksburg, VA 24061-0319. Phone: (703) 231-6885, Research (.75)/Teaching (.25): Systems Science & Artificial Intelligence, Time committed to this project 15%; John M. Luna, Department of Entomology, Extension (.75) Teaching (.25): Extension Coordinator for Sustainable Agriculture; Rosalind D. Buick, Department of Entomology, Research Associate (1.00): Plant Physiology and Knowledge-based Systems; John Roach, Department of Computer Science, Research/Teaching (9mo Acad Appt.): Knowledge-based Systems & AI; James W. Pease, Department of agricultural Economics, Extension (1.00): Farm Management; Lee Daniels, Department of Crop & Soil Environmental Sciences, Research (.85)/Teaching (.15): Soil Science; and Rebecca Scheckler, Department of Entomology, Research (1.00): Computer Programming, Knowledge-based systems.

COOPERATORS:

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Charles R. Meyer, Programmer/Analyst, USDA/ARS National Soil Erosion Research Laboratory, Purdue University, West Lafayette, Indiana 47907.

Tom Simpson, Teaching (.10): Extension (90) Nutrient Management, Department of Crop & Soil Environmental Sciences, Virginia Tech, Blacksburg, VA 24061; and Harlan E. White, Extension (1.00) Agronomist, Forages.

Don Tilmon, Extension Farm Management Specialist (.50), PLANETOR Coordination (.50), University of Delaware, Newark, DE 19711.

FARMER PARTICIPANTS:

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Sandy Fisher, Crop/Livestock operation, Brookview Farm, 854 Dover Road, Manakin/Sabot, VA 23103.

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Steve White, Vegetables, Rt. 2, Box 430-B, Asheville, North Carolina, 28805.

AS92-5: EFFECTS OF SUSTAINABLE AND CONVENTIONAL AGRICULTURE ON FARM WILDLIFE

PRIMARY INSTITUTION: North Carolina State University

OBJECTIVES:

(1) To compare the effects of sustainabale versus conventional crop management on the user of crop fields by bobwhite quail and other wildlife species.

(2) To determine the value of planted and non-planted habitats, such as field borders and ditch banks, as year-round habitat for quail and other wildlife species.

(3) To quantify direct and indirect effects of selected pesticides on bobwhite quail and other wildlife species.

(4) To compare the economic costs and benefits of wildlife habitat in sustainable versus conventional cropping environments.

(5) To utilize case studies of cooperating growers and a survey of landowners' attitudes on wildlife management to develop guidelines for persuading farmers and landowners' to adopt sustainable practices beneficial to wildlife.

(6) To offer viable suggestions for enhancing wildlife resources occupying the agricultural landscape without sacrificing farm profitability.

PROJECT DURATION: Three years

FUNDING: ACE Total $130,000 for 3 years
Matching Funds Total: $130,100 starting 1992.

PROPOSAL:

There is increasing evidence that current crop production methods adversely affect wildlife and other natural resources. The decline of the northern bobwhite quail is frequently cited by the scientific community and wildlife advocacy groups as an event that reflects the negative impacts of current agricultural practices on natural resources. The disappearance of viable quail populations on farms is most often attributed to increased use of pesticides and decreased habitat diversity. Sustainable agriculture, with its emphases upon reduced pesticide usage, ecological soundness and enterprise diversity offers opportunities for reversing the quail dilemma. Accordingly, a multi-disciplinary effort is proposed that will quantify and contrast the effects of conventional and sustainable crop production methods on the population, habitat and behavior of quail and other wildlife species. Data will be collected via several methods that include radio-

telemetry of wild quail, intensive field monitoring and the innovative use of imprinted quail chicks. Carefully controlled experiments will be conducted under realistic field conditions to predict exposure risks and document pesticide effects on bobwhite quail. The proposed project will also seek to enhance wildlife habitat in modern farming systems by developing the concept of "improved" filter strips and field borders. Economic costs and benefits associated with the response of wildlife to sustainable versus conventional agricultural systems will be determined and the economic potential of combined crop production/wildlife enterprises evaluated. The proposed project will involve unprecedented cooperation among university agronomists, wildlife scientists, pesticide experts and economists, state and federal wildlife managers, private wildlife interest groups, farmers and a foundation.

MAJOR PARTICIPANTS:

North Carolina State University: John R. Anderson Jr., (Project Coordinators) Associate Professor of Crop Science and Extension Specialist, Department of Crop Science, North Carolina State University, Box 7620, Raleigh, NC 27695-7620, Phone: (919) 515-5818, expertise in cropping systems management and Peter T. Bromley, (Project Coordinator) Associate Professor of Zoology and Wildlife Extension Specialist-in-Charge, Department of Zoology, expertise in wildlife management with emphasis upon wildlife enhancement on private land.

H. Michael Linker, Associate Professor of Crop Science and Integrated Pest Management Coordinator, Department of Crop Science, expertise in pesticide testing and management as well as implementation of integrated pest management programs; and Duane F. Neuman, Professor of Economics, Department of Agricultural and Resource Economics, expertise in farm management, enterprise budgeting and whole-farm economic analysis.

Carl W. Betsill, Research Director, North Carolina Wildlife Resources Commission, Raleigh, North Carolina, expertise in small game management and research administration.

Michael F. Corcoran, Executive Vice President, North Carolina Wildlife Federation, Raleigh, NC, expertise in fisheries biology, environmental management and public relations.

J.R. Evans, Executive Vice President, Quail Unlimited, Inc., Augusta, Georgia, expertise in quail management and public relations.

W.J. Fleming, Head, U.S. Fish and Wildlife Cooperative Research Unit, North Carolina State University, Raleigh, North Carolina, expertise in wildlife toxicology.

R.E. Noffsinger, Biologist, Alligator River National Wildlife Refuge, U.S. Fish and Wildlife Service, Manteo, North Carolina, expertise in wildlife and farm management.

Joyce M. Woodhouse, Administrative Secretary, Corn Growers' Association of North Carolina, Raleigh, North Carolina, expertise in communications.

AS92-6 USE OF ORGANIC NITROGEN SOURCES FOR SWEETPOTATOES: PRODUCTION POTENTIAL AND ECONOMIC FEASIBILITY (Will begin as SARE project **LS92-46** for a duration of 31.5 months (with $105,000 of SARE funds and $44,126 of Matching Funds) then continue as ACE project **AS92-6** for the remaining 4.5 months with $15,000 of ACE funds and $6,594 of Matching Funds).

OBJECTIVES:

(1) To evaluate yield, quality, and nitrogen cycling in sweetpotaotes using crimson clover as an organic source of nitrogen in different soil types in the Southeast.

(2) To evaluate the effect of crimson clover as an organic N source on nitrogen use efficiency (NUE) of different sweetpotato genotypes (including the effect of time of N availability relative to vine growth, storage root initiation and storage root bulking of individual genotypes) to determine potential for selecting for NUE.

(3) To evaluate the effect of crimson clover as an organic N source on sweetpotato and corn yield and quality (including observational data on disease, insect and weed problems) in a two-year rotation cycle when replacing all or part of the N applied from inorganic sources in the two-year cycle.

(4) To determine the economic feasibility of using crimson clover as an organic source of nitrogen for sweetpotato alone and in a two-year rotation cycle with corn.

PROJECT DURATION: 4.5 months under ACE; two years + 7.5 months under SARE (project LS92-45). Total three years.

FUNDING: $15,000 (ACE share only) of total $120,000 for project. Matching, $6,340 (ACE share only) of total $50,720 for project.

PROPOSAL:

This is a three-year project designed to precisely test

MAJOR PARTICIPANTS:

North Carolina State University: Wanda W. Collins (Project Coordinator), Vegetable Breeder, 210 Kilgore Hall, Department of Horticultural Science, Box 7609, Raleigh, NC 27695-7609, Phone: (919) 515-3167. D. S. Sanders, Department of Horticultural Science, Extension, Vegetable Production Systems; Jonathan Schultheis, Horticulture: Extension, Sweetpotatoes; David Monks, Horticulture: Extension, Vegetables, Weed Management. Edmund Estes, Department of Agriculture and Resource Economics, Extension, Farm Management and Marketing; Mary Barbercheck, Department of Entomology, Research, Soil Insects. Greg Hoyt, Mountain Horticultural Crops Research Station, Department of Soil Science, Research Alternative Crop Production Systems, Fletcher, NC.

Tuskegee University: Conrad K. Bonsi, George Washington Carver Agricultural Experiment Station, Tuskegee Institute, Alabama, Agricultural Science, Crop Protection.

North Carolina Coalition of Farm and Rural Families: Tony Alexander, Marketing Specialist, Durham, NC.

South Macon County Cooperative: P.O.Box 1186, Tuskegee, AL 36088.

Farmer Participants:

Kendall Hill, Tull Hill Farms, Kinston, NC and Ralph Batchelor, Route 3, Nashville, NC.

Results

Project activities were initiated in the summer of 1992 with an extensive pot culture study of sweetpotatoes designed to determine how nitrogen affects the growth of sweetpotato. In the fall, crimson clover cover crops were planted in six locations in two states, as the first step in the studies which will provide the bulk of this project data.

AS93-7: EVALUATION OF RECYCLED PAPER MULCH AS AN ALTERNATIVE TO BLACK PLASTIC MULCH IN VEGETABLE HORTICULTURE

PRIMARY INSTITUTION: Virginia Association for Biological Farming

OBJECTIVES:

(1) Identify advantages and problems of mulching systems used by commercial vegetable growers, and research priorities in mulching methods.

(2) Evaluate recycled paper film and organic mulches as sustainable alternatives to plastic film mulch, considering horticultural performance, effects on soil conditions, costs and benefits to the grower, resource consumption, solid waste reduction, and other environmental impacts.

(3) Disseminate information on horticultural, soil, economic, and ecological merits of different mulches so growers can make informed choices appropriate to their specific sites and operations.

(4) Evaluate methods for delaying breakdown of paper mulch under field conditions.

(5) Explore the feasibility of manufacturing a recycled paper mulch using environmentally benign processes with potential as a small business venture.

PROJECT DURATION: Two years

FUNDING: ACE: $40,000.
Matching Non-Federal: $10,100.

PROPOSAL:

Plastic film mulches conserve moisture and reduce the need for herbicides, but consume fossil fuel, add costs for end-of-season disposal, and overload landfills. Mulches derived from recycled paper or yard wastes could control weeds, conserve water, improve soil conditions, reduce environmental costs, and save landfill space.

This project will compare plastic, recycled paper mulch, and organic mulches in terms of horticultural performance, effects on soil conditions, costs and benefits to the grower, suitability for small- to medium-scale farms, resource and energy costs of manufacture, and environmental impacts from fabrication through disposal.

Information will be gathered through interviews of vegetable growers on conventional, transitional, and sustainable farms in Virginia and neighboring states, two years of on-farm field trials, and a literature survey. Simple methods for delaying breakdown of paper mulches will be evaluated, and the feasibililty of manufacturing recycled paper mulch on a small scale using an environmentally benign process will be explored. Mulches derived from yard wastes and other organic materials will also be tested.

Results will be published as articles for a refereed journal and one or more farmers' publications, and at least three information sheets will be distributed through VABF and Extension. Farm field days will be conducted on at least one participating farm each year.

Objective 1: At least thirty vegetable growers on conventional, transitional, and sustainable farms in Virginia and neighboring states will be interviewed. Each grower will be asked about his/her cultural methods for producting solanaceous and curcurbit vegetable crops, with emphasis on mulching system, used, its advantages, costs, and any problems encountered. Questions will be designed to identify research needs in mulching methodology from a grower's viewpoint.

Objective 2: Two years of field trials will be conducted, comparing the effects of different mulching systems on crop yield, quality and earliness, weeds, disease and insect pests, and soil conditions. Farmers will participate in conducting the experiments and evaluating the overall cost-effectiveness of each mulching system. Total and marketing yields, severity and date of onset of diseases and pests will be recorded. Foliage samples will be collected for nutrient analysis. Weeds will be harvested and weighed, and soil temperature and moisture measured. Bulk density, aggregate stability, water infiltration rate, and earthworm numbers will be recorded at the end of harvest. Mulch will then be removed and a ryegrass cover crop planted in all plots to assess residual effects of different mulches.

Objective 3: Results of the two years of field trials will be published as articles for a refereed journal and one or more farmers' publications, plus at least three information sheets to be distributed through VABF and Extension. Farm field days will be conducted on at least one participating farm each year.

Objective 4: Paper mulch samples will be treated with various vegetable oils to determine if these treatments delay the breakdown of paper mulch under field conditions.

Objective 5: A steam-explosion process will be used for pulp preparation at a pilot plant at Virginia Polytechnic Institute. If a workable process is developed, samples of paper mulch will be analyzed for PAH and dioxin content. An economic analysis will be conducted to compare this product with commercially available paper products.

MAJOR PARTICIPANTS:

Virginia Association for Biological Farming: Mark W. Schonbeck (Project Coordinator), Crop Scientist and Gardener, Route 1, Box 35, Check, VA 24072. Phone (703) 651-3412. John O'Malley Burns, President, VABF, Washington, VA, administrator for project.

Virginia Polytechnic Institute and State University: Gregory K. Evanylo, Associate Professor and Extension Soil Scientist, Blacksburg, VA. Archer Christian, Graduate Student, Soil Science, Blacksburg, VA 1will serve as research associate.

Appalachian Regional Recycling Consortium: Patricia A. Therrien, Director, Radford, VA, will act as consultant for recycled paper mulch feasibility study and process development.

Parsons Brinckerhoff, Inc.: Ralph E. DeGregorio, Pest Management Consultant, Arlington, MA, will act as consultant for environmental and agricultural cost-benefit analysis.

PARTICIPATING FARMERS:

William A. Bason, Market gardener, Floyd, VA, participant, field trials 1993-94.

Jacob Kawatski, Manager, Twin Oaks Gardens, Louisa, VA, participant, field trials 1993-94.

Charles Maloney, Farm Manager, Dayspring Farm, Cologne, VA, participant, field trials, 1994.

Ellen Polishuk, Potomac Vegetable Farms, Vienna, VA, participant, field trials, 1994.

AS93-8: DEVELOPMENT OF SUSTAINABLE AREA-WIDE WEED MANAGEMENT PRACTICES FOR IMPROVED LAND UTILIZATION

PRIMARY INSTITUTION: **University of Tennessee**

OBJECTIVES:

(1) To establish and maintain on-farm field insectaries in GA, NC, TN, and VA for propagation of two introduced thistle-feeding biological control agents.

(2) To develop a distribution plan to provide biological control agents to landowners and agencies for release in thistle-infected areas.

(3) To develop and implement a regional educational program (through grower education days, field days, county meetings, publications, etc.) to improve public (i.e. farmers, landowners, schools, organizations, state and federal agencies, etc.) awareness of sustainable management systems using this program as a model.

(4) To assess the economic and environmental benefits of this type of sustainable weed management program.

PROJECT DURATION: Three years

FUNDING: ACE: $165,000.
Matching Non-Federal: $133,000.

PROPOSAL:

Musk thistle is a noxious plant pest impacting land utilization over a broad geographical region. This project involves farmer education and the functional integration of research technology for implementation of sustainable management of musk thistle, *Carduus thoemeri* Weinmann, into ongoing farm systems via the release and establishment of two indroduced thistle-feeding biological control agents. These agents, *Rhinocyllus conicus* and *Trichosirocalus horridus*, feed specifically on thistle and pose no threat to agricultural crops. This control program has been shown to reduce thistle infestations by 70-95%. This multi-disciplinary, multi-institution/agency, multi-state project involves a wide range of participants:

MAJOR PARTICIPANTS:

University of Tennessee: Jerome F. Grant (Project Coordinator), Entomology and Plant Pathology Department, PO Box 1071, Knoxville, TN 37901-1071. Phone: (615) 974-7135. Paris L. Lambdin, Entomology and Plant Pathology Department, Knoxville.

University of Georgia: David Buntin, Research Entomologist, Griffin, GA. Randy Hudson, Entomologist, Tifton, GA.

North Carolina Department of Agriculture: Richard McDonald, Entomologist, Raleigh, NC.

Virginia Polytechnic Institute and State University: Loke Kok, Entomology Department, Blacksburg, VA.

PARTICIPATING FARMERS:

Tennessee: Joe Fite, Giles County; P. C. Hannah, Giles County; Jim Howell, Hamblen County; Tom Price, Giles County; Bennie Richards, Robertson County; Charles Spurlock, Robertson County.

Georgia: Roger Bruce, Morgan County; Tommy Cathey, Morgan County; Jimmy Hamil, Haralson County; John Maddox, Jr., Morgan County; Curtis Miller, Haralson County; Jimmy Smith, Haralson County; Larry Taylor, Morgan County.

North Carolina: Gene Freeman, Cleveland County; Burder Reeves, Madison County.

OTHER COOPERATORS:

University of Tennessee: Eugene Burgess, Extension Specialist, Entomology; Neil Rhodes, Extension Specialist, Weed Science; Steven D. Mundy, Extension Specialist, Agricultural Economics

University of Tennessee Agricultural Extension Service (county agents): Don Malone, Robertson County; David Qualls, Giles County; Bob Sliger, Monroe County; James Bond, Hamblen County

Tennessee Department of Agriculture: Steve D. Powell, State Entomologist

Tennessee Department of Transportation: Patrick Thurman, Horticulturist

University of Georgia: Vaughn Calvert, Central Georgia Branch Station

University of Georgia Cooperative Extension Service (county agents): John C. Callaway, Jr., Haralson County; John D. Parks, Jr., Jackson County; C. Wayne Tankersley, Morgan County

North Carolina State University Cooperative Extension Service (county agents): Gary Ealey, Madison County; Steve Gibson, Cleveland County

AS93-9: USING SOLDIER FLIES AS A MANURE MANAGEMENT TOOL FOR VOLUME REDUCTION, HOUSE FLY CONTROL AND FEEDSTUFF PRODUCTION

PRIMARY INSTITUTION: University of Georgia

OBJECTIVES:

(1) To determine the depth of manure basin necessary to allow soldier fly larvae to utilize manure accumulated during the previous winter.

(2) To characterize nutrients in layer manure with and without soldier fly larvae.

(3) To evaluate manure reduction, especially of winter accumulation.

(4) To evaluate soldier fly larvae feedstuff production, quality and utilization.

(5) To determine the feasibility of using this system in high-rise layer houses.

PROJECT DURATION: 23 months ACE; 1 month SARE, for a total of 2 years.

FUNDING: ACE: $49,100; will receive SARE funding in amount of $2,150 as project LS93-56 for a total of $51,250.
Matching Non-Federal: $12,300 for ACE; $513 for SARE

PROPOSAL:

This project utilizes the black soldier fly (*Hermetia illucens*), which occurs worldwide in the tropics and temperate regions, as part of a manure management system for caged layers. The soldier fly larvae (SFL) occur in very dense populations on various organic wastes, and exclude other flies. In this system, wild populations of SFL will be managed in concrete basins under the hens to eliminate house fly breeding; to eliminate half of the manure through incorporation into larval biomass; and to produce large quantities of high-quality feedstuff through self-harvest of prepupae.

The primary objective of the project is to detemine pit depth and management necessary to allow SFL to utilize winter accumulated manure, which would further reduce manure handling and pollution potential and increase feedstuff production. The system will be incorporated into a small-scale hight-rise layer house. In addition, plant nutrients in the manure residue will be characterized and feedstuff production will be quantified and evaluated for quality.

MAJOR PARTICIPANTS:

University of Georgia: D. Craig Sheppard (Project Coordinator), Entomology Department, Coastal Plain Experiment Station, Tifton, GA 31793. Phone: (912) 386-3374. Role: insect population management, poultry house management. Larry Newton, Animal Science Department, Tifton, GA. Role: waste Management, larvae utilization. Sidney

Thompson, Biological and Agricultural Engineering Department, Athens, GA 30602. Role: structures and equipment design and construction. Jessica Davis-Carter, Agronomy Department, Tifton, GA. Role: characterization of nutrient form and content. Stan Savage, Extension Poultry Science, Rural Development Center, Tifton, GA. Role: hen care, management and nutrition consultant, producer feedback.

American Protein, Inc.: Mark Silva, Roswell, GA 02747. Role: feedstuff rendering, characterization.

AS93-10: USE OF POULTRY LITTER AS A SOIL AMENDMENT IN SOUTHERN ROW CROP AGRICULTURE: A FEASIBILITY STUDY BASED ON AGRONOMIC, ENVIRONMENTAL, AND ECONOMIC FACTORS [A continuation of SARE project LS91-39(27)]

PRIMARY INSTITUTION: University of Arkansas

OBJECTIVES:

(1) To quantify both the short-term and long-term agronomic value of poultry litter (PL).

(2) To document the environmental consequences of land applicaton of PL in the row crop regions.

(3) To estimate, using the agronomic data on yield responses, the farm level derived demand for PL and PL compost as a soil amendment; and to integrate the derived demands with costs of aquisition, transportation, and application to determine the market feasibility of PL transport from areas of high poultry concentration.

PROJECT DURATION: One year [extension of project LS91-39(27)]

FUNDING: ACE: $100,000.
Matching Non-Federal: $64,043.

PROPOSAL:

Poultry litter (PL) is a valuable, abundant, but underutilized agronomic resource throughout much of the southeastern U.S. Instead of being used to enhance the productivity of teh region's agriculturally important soils, most PL is disposed of on conveniently located pastureland, where frequent heavy applications result in the addition of excessive quantities of nutrients which now threaten local water supplies. Both water quality in poultry producing regions and prospects for reduced dependence on inorganic fertilizers and sustained agricultural productivity in the row crop regions would improve if PL were to be used as a soil amendment in southeastern row crop agriculture.

In the first two years of this project, it has been demonstrated that in certain situations, the use of PL by row crop producers is economically feasible. In Arkansas, where the most thorough economic analysis has been conducted, these situations invariably involve soils that have been disturbed, usually by land-forming operations. On these soils, productivity is restored more effectively by applications of PL than by applications of inorganic fertilizers. In Alabama, similar observations have been made on highly eroded soils. Additional studies will be conducted in this third year of the project to identify the types of soils most likely to respond to applicaton of PL.

MAJOR PARTICIPANTS:

University of Arkansas: David M. Miller (Project Coordinator), Assistant Professor of Soil Chemistry, Agronomy Department, 115 Plant Science Building, Fayetteville, AR 72701. Phone: (501) 575-5747. Mark J. Cochran, Professor, Agricultural Economics and Rural Sociology Department, Fayetteville. Craig S. Rothrock, Associate Professor, Plant Pathology Department, Fayetteville. James S. McConnell, Associate Professor, Agronomy Department, Southeast Research and Extension Center, Monticello. Richard J. Norman, Professor, Agronomy Department, Rice Research and Extension Center, Stuttgart.

Arkansas Cooperative Extension Service: Ronnie S. Helms, Extension Agronomist - Rice, Rice Research and Extension Center, Stuttgart. Nathon Slaton, Area Rice Specialist, Rice Research and Extension Center, Stuttgart.

Auburn University, AL: C. Wesley Wood, Associate Professor, Agronomy and Soils Department, Auburn, AL 36849-5412.

Alabama Cooperative Extension Service (county agents): Clayton Hoomes, Blount County; Greg Hodges, Cullman County; Curtis O'Daniel, DeKalb County; Robert Hughes, Lauderdale County; Curtis Grissom, Limestone County; Frank Wood, Marshall County.

PARTICIPATING FARMERS:

Arkansas: George Dunklin, Arkansas County.

Alabama: Jerry Yancey, Cullman County; Don Newbern, Lauderdale County; Henry and Tim Whitley, Blount County; David Johnson, DeKalb County; Kenneth Martin, Marshall County.

AS93-11: USE OF POULTRY LITTER OR MANURE FOR ROOT-KNOT NEMATODE MANAGEMENT ON VEGETABLES AND FIELD CROPS

PRIMARY INSTITUTION: Clemson University, SC

OBJECTIVES:

(1) To evaluate poultry manure and litter as soil amendments for suppression of root-knot nematodes (*Meloidogyne* spp.) and enhancement of plant growth in field and microplot experiments.

(2) To elucidate the role of soil temperature and moisture variables as factors affecting nematode suppression by poultry manures and litter known to vary in teh proportion of total nitrogen as NH_3.

(3) To evaluate application protocols and economic benefits of poultry litter as a suppressant of plant-parasitic nematodes and as a plant nutrient source on vegetable and row crops using standard production practices with on-farm cooperators.

PROJECT DURATION: Two years

FUNDING: ACE: $99,900.
Matching Non-Federal: $81,000.

PROPOSAL:

Root-knot nematodes (RKN) are a serious threat to profitable and sustainable vegetable and field crop production in the South. As a result of wide-spread infestations of RKN, nematicides are commonly used in many cropping systems with the potential of contaminating surface and ground water. Host plant resistance can not completely solve this problem because RKN have a wide host range and are a genetically diverse group of pathogens. The use of nitrogen-rich organic amendments to suppress RKN is well documented and may provide an alternative to synthetic pesticides.

Previous work has demonstrated the ability of poultry litter and manure soil amendments to suppress RKN; however, several difficulties exist: a lack of understanding of the effects of nitrogen form [proportion of total N in the ammonia (NH_3) form] on nematode populations; the role of environmental conditions such as soil temperature and moisture on poultry litter or manure induced nematode suppression; and the balancing of plant nutrient requirements with manure or litter levels sufficient for nematode suppression.

This project will determine the effect of poultry litter and manure on RKN infection, reproduction, and plant nutrition. This information will be used to assess the impact of litter and manure on profitability and sustainability of cropping systems representative of the southeastern U.S. A detailed economic analysis will be conducted on farms using poultry litter or manure as a nematode suppressant and as a plant nutrient source.

MAJOR PARTICIPANTS:

Clemson University, Pee Dee Research and Education Center: Bruce A. Fortnum (Project Coordinator), Professor, Plant Pathology and Physiology Department, Route 1 Box 531, Florence, SC 29501. Phone: (803) 669-1912, ext. 235. James J. Camberato, Assistant Professor, Agronomy and Soils Department, Florence, SC. J. Thomas Garrett, Associate Professor, Horticulture Department, Florence, SC.

South Carolina Cooperative Extension Service: Toby Boring, Extension Agricultural Economist, PO Box 2377, Sumter, SC 29151.

OTHER COOPERATORS:

Clemson University: Daniel Smith, Professor, Agricultural Economics Department, Clemson, SC. Gloria McCutchen, Associate Professor, Entomology Department, Clemson, SC. Ted Whitwell, Associate Professor, Horticulture Department, Clemson, SC.

South Carolina Cooperative Extension Service (county agents): Randy Cubbage, Lee County; Russell Duncan, Clarendon County.

PARTICIPATING FARMERS:

Claude Elmore, Jr., Lee County, Bishopville, SC.
Gill Rogers, Darlington County, Hartsville, SC.
Vikki Brogdon, Clarendon County, Manning, SC.
Billy Simpson, Clarendon County, Manning, SC.

SUBJECT INDEX